FIELD TRIALS OBSERVING WIND/WAVE DRAG ON THE BIO BARREL DRIFTERS AND OTHER LAGRANGIAN SURFACE DRIFTERS

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Les établissements de l'ancien secteur des Sciences et Levés océaniques dans les régions et à l'administration centrale ont cessé de publier leurs diverses séries de rapports en décembre 1981. Vous trouverez dans l'index des publications du volume 38 du *Journal canadien des sciences halieutiques et aquatiques*, la liste de ces publications ainsi que le dernier numéro paru dans chaque catégorie. La nouvelle série a commencé avec la publication du rapport numéro 1 en janvier 1982.

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Field Trials Observing Wind/Wave Drag on the BIO Barrel Drifter and other Lagrangian Surface Drifters

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ABSTRACT

Elliott, J.A., and Fowler, G.A. 2018. Field Trials Observing Wind/Wave Drag on the BIO Barrel Drifter and other Lagrangian Surface Drifters. Can. Data Rep. Fish. Aquat. Sci. 1283: v + 256p.

A series of field trials are reported that document the drift tracks of Lagrangian drifters deployed in the Bedford Basin and at the entrance of Halifax Harbour. These drifters have been designed to follow near surface water movement; they include: BIO Barrel Drifters, Hermes Drifter, Orion 4800, Orion Tracker Buoy, Nova Tech 200, and BIO Tarball Tracker. This data set is part of an experimental evaluation of the ability of these buoys to follow oil in the near surface. The data are presented as plan view position plots with calculated mean velocities, and plots of wind speed and buoy velocity as a function of time.

RÉSUMÉ

Elliott, J.A., and Fowler, G.A. 2018. Essais sur le terrain pour observer la résistance au vent/aux vagues de la bouée dérivante de l'Institut océanographique de Bedford (IOB) et d'autres bouées lagrangiennes. Can. Data Rep. Fish. Aquat. Sci. 1283: v + 256p.

Une série de rapports d'essais de terrain décrivent les trajectoires de dérives des bouées lagrangiens déployées dans le bassin de Bedford et à l'entrée du port d'Halifax. Ces bouées ont été conçues pour surveiller le mouvement de l'eau près de la surface; ils comprennent ce qui suit : bouées dérivantes de l'Institut océanographique de Bedford, flotteur Hermes, Orion 4800, bouée de surveillance Orion, Nova Tech 200 et outil de suivi des boules de goudron de l'Institut océanographique de Bedford. Cet ensemble de données fait partie d'une évaluation expérimentale de la capacité de ces bouées de surveiller le pétrole situé près de la surface. Les données sont présentées à titre de tracés de terrain dans la vue en plan avec des vélocités moyennes calculées, et de tracés de vitesse des vents et la vélocité des bouées sont présentées à titre de fonction du temps.

ACKNOWLEDGEMENTS

This report is based on an unpublished contracted report submitted in 1985. Core funding was provided by the NRCan 'Panel of Energy Research and Development' (PERD). The field program was partially supported by the Canadian Offshore Oil Spill Research Association (COOSRA) which enabled this project to proceed successfully during 1982 and 1983. Additional and necessary field support in the form of helicopter service and offshore ship operations was provided by the Canadian Coast Guard, Dartmouth. The Hydrographic Service provided the positioning equipment. R. Belanger took the aerial photographs. The project was further supported by the willing co-operation of many members of the BIO technical shops. Thanks to Ross Hendry and Herb Vandermeulen for their reviews.

1. INTRODUCTION

Responding to recent national interest in establishing science-based oil spill prevention and response plans, the Department of Fisheries and Oceans (DFO) has undertaken a number of studies to evaluate environmental sensitivity and response-readiness of several major shipping port sites under consideration. One of these (Drozdowski, et al. 2018), a BIO based study, is located in the vicinity of the greater Port Hawkesbury area. Present day field work and modelling of the physical oceanographic environment in this complex coastal system are aimed at providing real time products deemed necessary for marine/tanker safety and for environmental response. This effort is part of the broader objectives of the World Class Tanker Safety Systems (WCTSS) program. Knowledge of the currents, particularly surface currents, is a priority. In addition to providing input to safe navigation, accurate modelling of this upper zone is needed for the prediction of realistic oil spill trajectories. Time series velocity measurements are being obtained from moored Acoustic Doppler Current Profilers (ADCPs), with a nominal accuracy of ±1 cm/s. However since ADCPs have a less and uncertain accuracy in the upper 10% of the water column, free floating drifting buoys are being used for comparison.

The drifters in use, the BIO Barrel Drifters, are a design based on earlier field programs, modified with modern tracking technology. A detailed field evaluation was held in the early 1980's to evaluate the inherent wind/wave drag error. Subsequently, the design was transferred under licence to industry. A commercial product followed and was in use by the 'oil industry' for potential oil spill tracking and by the Canadian Coast Guard for emergency response issues. Internal documentation of the field evaluation was, however, incomplete. The only record is a first-draft, unpublished report White et al. (1983), containing data collected up to March, 1985. This one remaining paper copy, in two parts, is in the 'OERD Library' within the BIO Library. A digital version has recently been archived.

The purpose of this document is to revisit the unpublished documentation and make available a published précis for use in present and future studies. Both current authors were participants in the original design and field program components. Most of this document consists of scanned pages from White et al. (1983) and from an undated set of Appendices. Double quotes are used when quoting from the original text.

There were two objectives for the 1980's work. First, was to develop a surface drifter suitable for offshore deployment, that was capable of assisting with tracking an oil spill, and second, to evaluate the performance of various existing commercial or commonly used oil-spill tracking buoys relative to the BIO drifter. The objective of this present analysis is to evaluate the BIO Barrel Drifter as a suitable complement to the ADCP current profiles with a target accuracy of ± 1 cm/s.

Figure 1 shows, in profile, the suite of drifters evaluated. The BIO Barrel Drifter now in use is the one labelled BIO medium mast (the mast simulates the antenna case). Five other variants of this design were deployed: BIO large, small, and no mast; half depth; and quarter depth. Four commercially available drifters were included: Hermes, Orion 4800, Nova Tech 200RF, and Orion Tracker. Tarball Tracker was an 'in-house' addition.

To accommodate accurate position fixing, most of the field program was conducted in the Bedford Basin. A more limited data set used an area near the mouth of Halifax Harbour for tests in open ocean conditions.

Following are descriptions of the various drifters and details of the data collection process, including expected errors. Appendix A contains Tables A1 and A2 with some dynamics and dimensions of the drifters. Appendix B is the data collected in Bedford Basin. Appendix C is the data from offshore deployment in test oil slicks.

2. BIO DRIFTER DESIGN

A 3-D diagram of the BIO Barrel Drifter is shown in Figure 2. The basic construction was a plastic barrel of 120 L (litres) (normally used for pickling fish and commonly called 'polar barrel'). Five centimetre diameter holes were drilled in the barrels to provide quick and uniform filling of sea water upon deployment. The barrels were ballasted by the addition of chain inside at the bottom of the barrel. Three ballast weight were tried: 10 kg, 20 kg and 30 kg. Pieces of foam board were added to the underside of the lid to achieve a constant 2.5 cm free-board on all variants of the buoys. For the trials, three mast diameters were used: 2.4, 11, and 29 cm. The weights of the masts were designed to be approximately the same. The inertial component

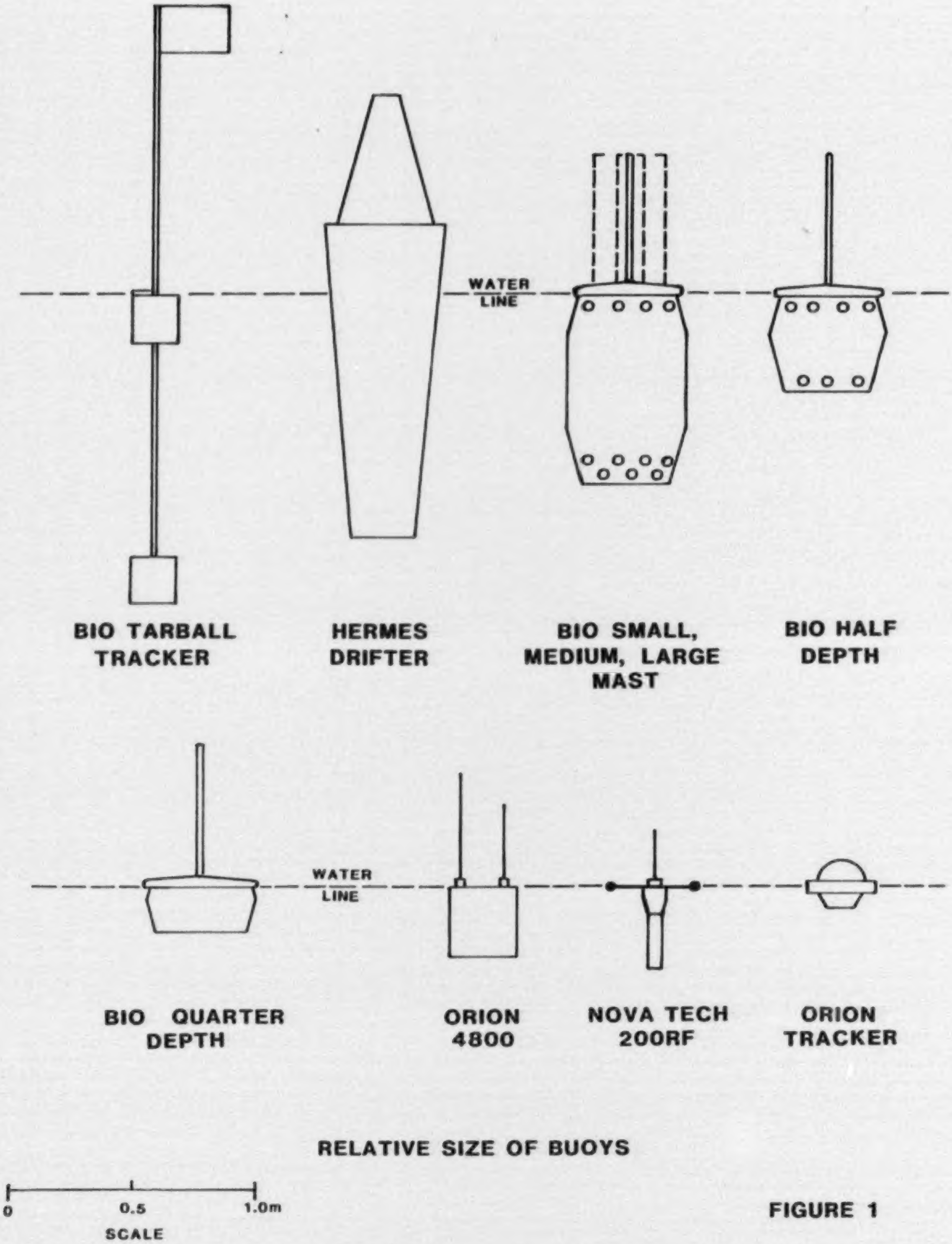

WATER LINE
BIO TARBALL TRACKER
HERMES DRIFTER
BIO SMALL, MEDIUM, LARGE MAST
BIO HALF DEPTH
WATER LINE
BIO QUARTER DEPTH
ORION 4800
NOVA TECH 200RF
ORION TRACKER
RELATIVE SIZE OF BUOYS
0
0.5
1.0m
SCALE
FIGURE 1

Figure 1: Schematic profiles of the drifters included in the field trials.

of pitch/roll stability was found to be nearly constant for all three with a given ballast. Table A1 in Appendix A summarizes size and weight characteristics, and tilt resonance and heave periods. The final design, the BIO Barrel Drifter, has a 77.5 cm by 44 cm barrel, and a 59.5 cm by 11 cm mast. It is listed in Appendix A, Table A1 and A2, as 'M^1 BIO medium mast'.

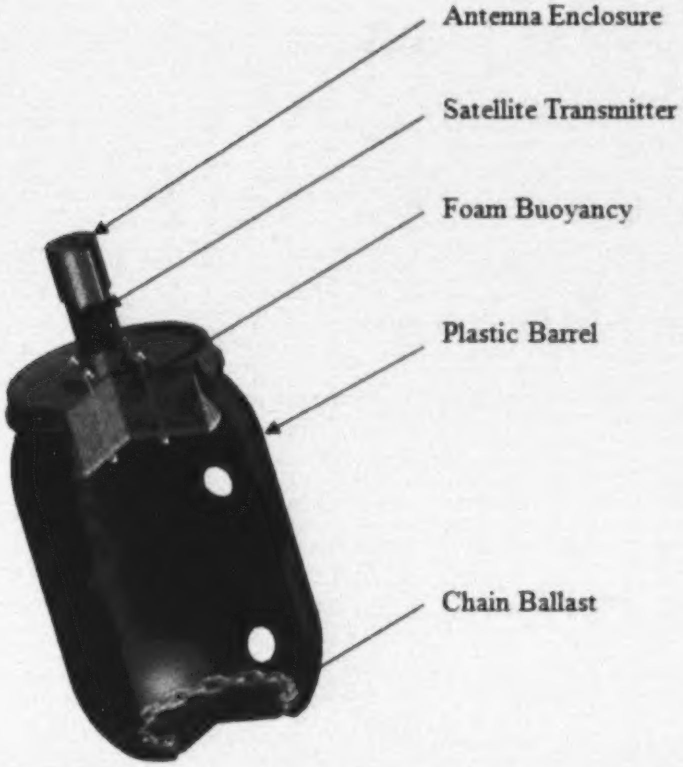

Antenna Enclosure
Satellite Transmitter
Foam Buoyancy
Plastic Barrel
Chain Ballast

Figure 2: A 3-D diagram of the BIO Barrel Drifter showing construction details. In Figure 1 it is BIO medium mast. The other versions labelled as small and large mast, and half and quarter depth, are of the same construction.

The legend below defines the labels used in Appendix B for the various versions tested: for example, 5L means that five BIO Large Mast, Full Depth, 10 kg buoys were part of that Trial.

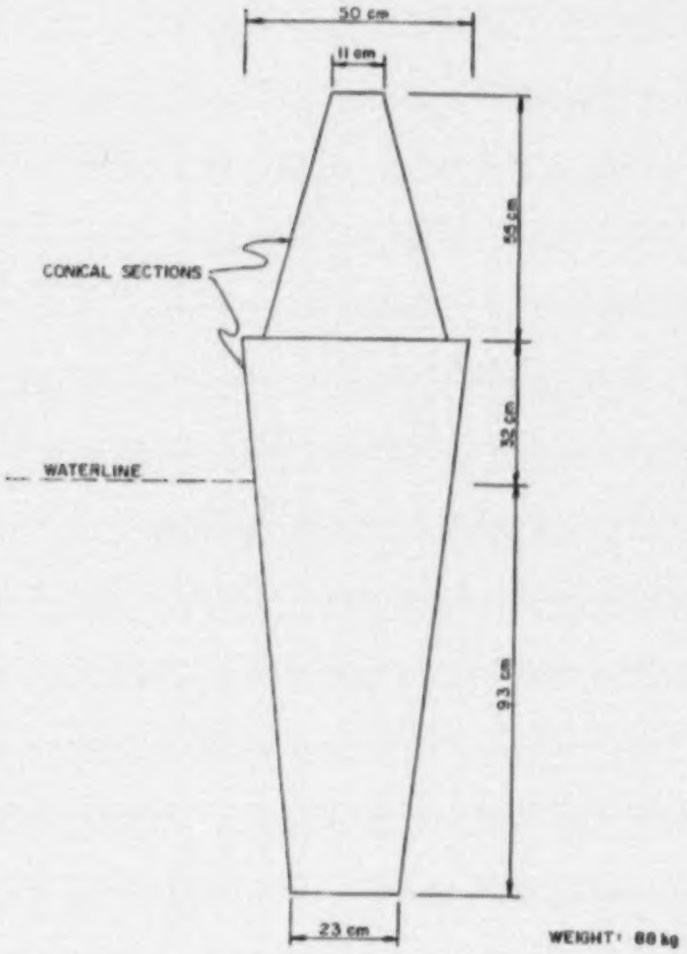
L - BIO, Large Mast, Full Depth, 10 kg
M - BIO, Medium Mast, Full Depth, 10 kg
S - BIO, Small Mast, Full Depth, 10 kg
X - BIO, No Mast, Full Depth, 10 kg
L^1 - BIO, Large Mast, Full Depth, 20 kg
M^1 - BIO, Medium Mast, Full Depth, 20 kg
S^1 - BIO, Small Mast, Full Depth, 20 kg
X^1 - BIO, No Mast, Full Depth, 20 kg
L^2 - BIO, Large Mast, Full Depth, 30 kg
M^2 - BIO, Medium Mast, Full Depth, 30 kg
S^2 - BIO, Small Mast, Full Depth, 30 kg
X^2 - BIO, No Mast, Full Depth, 30 kg
L/2 -BIO, Large Mast, Half Depth, 10 kg
M/2 - BIO, Medium Mast, Half Depth, 10kg
S/2 - BIO. Small Mast, Half Depth, 10 kg
S/4 - BIO, Small Mast, Quarter Depth, 10 kg
L^1/2 - BIO, Large Mast, Half Depth, 20 kg
M^1/2 - BIO, Medium Mast, Half Depth, 20 kg
S^1/2 - BIO, Small Mast, Half Depth, 20 kg

3. DESIGN OF OTHER DRIFTERS TESTED

Four types of commercial buoys and the BIO Tarball buoy (Figure 1) were evaluated in Trials 8 to 16. A detailed sketch of each with dimensions are shown below:

- **Hermes** Standard Drifting Buoy, Figure 3
- **Orion 4800** System, Transponder Buoy, Figure 4
- **Orion Tracker** Buoy, Figure 5
- **Nova Tech** 200 RF, with oil tracking skirt, Figure 6
- **Tarball** Tracker (BIO design), Figure 7

Additional performance detail is given in Tables A1 and A2, Appendix A.


50 cm
11 cm
55 cm
CONICAL SECTIONS
32 cm
WATERLINE
93 cm
23 cm
WEIGHT: 88 kg

HERMES DRIFTER BUOY

Figure 3

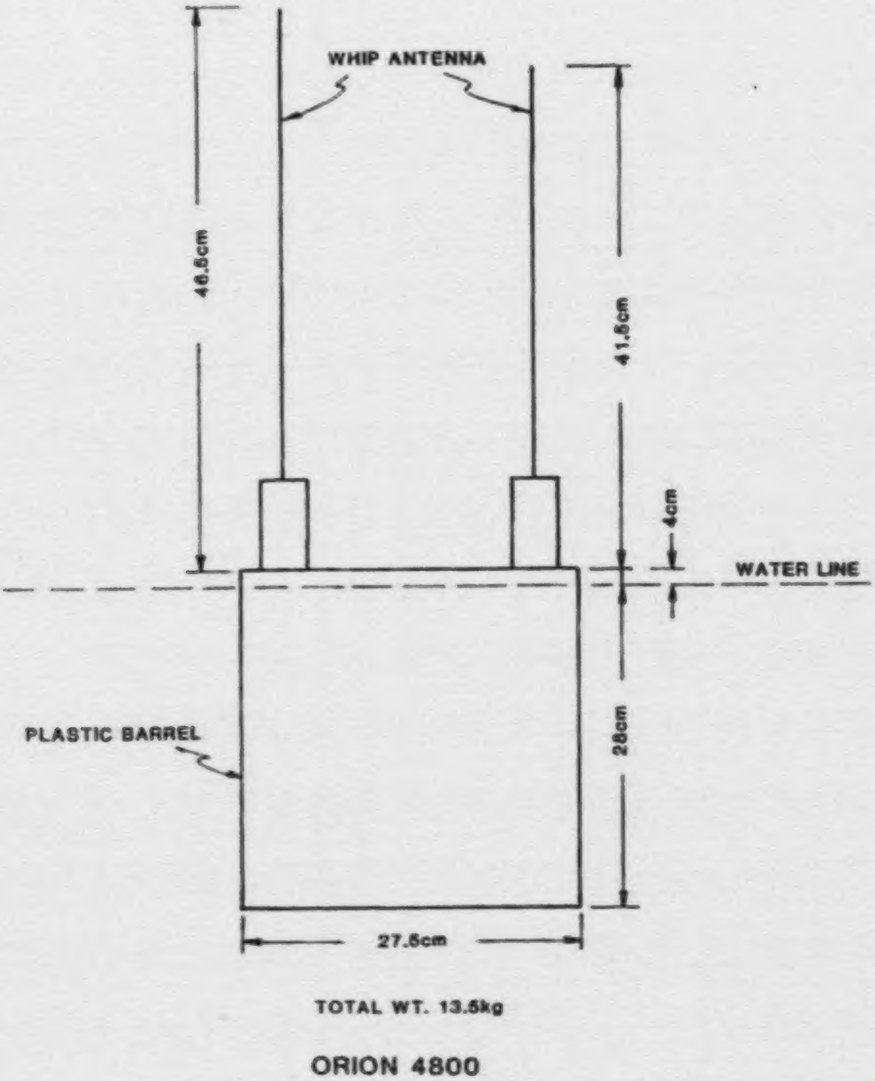
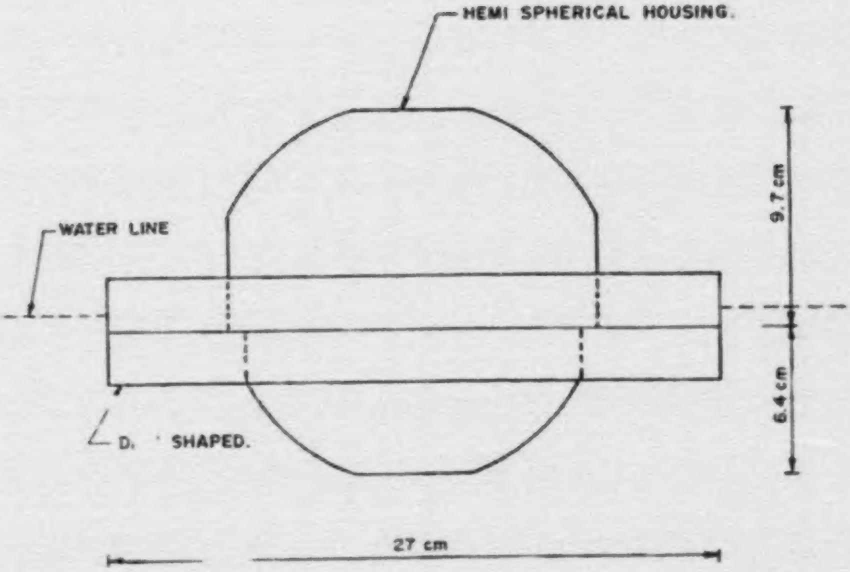

WHIP ANTENNA
46.5cm
41.5cm
4cm
WATER LINE
PLASTIC BARREL
28cm
27.5cm
TOTAL WT. 13.5kg
ORION 4800

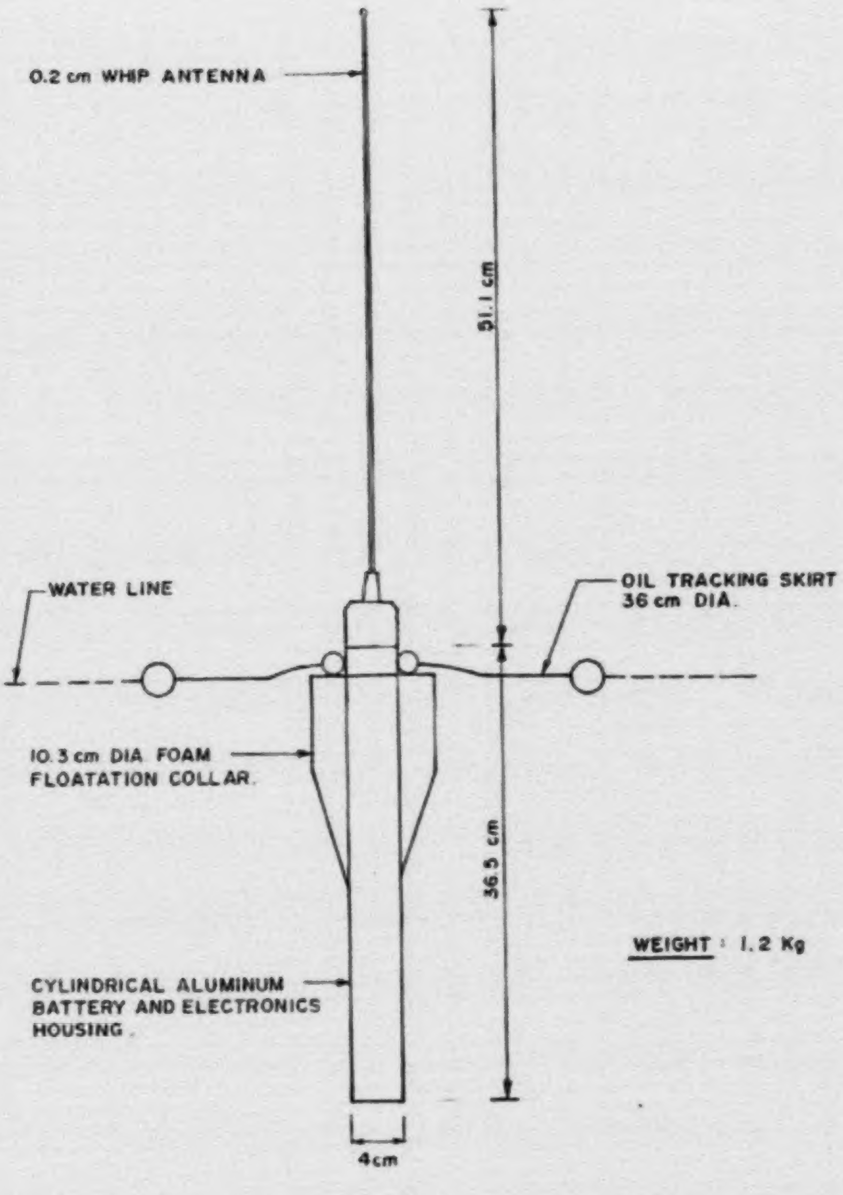
Figure 4


HEMI SPHERICAL HOUSING.
WATER LINE
D. SHAPED.
9.7 cm
6.4 cm
27 cm

WEIGHT: 1.5 Kg

ORION TRACKER

Figure 5


0.2 cm WHIP ANTENNA
51.1 cm
WATER LINE
OIL TRACKING SKIRT
36 cm DIA.
10.3 cm DIA FOAM
FLOATATION COLLAR.
36.5 cm
WEIGHT : 1.2 Kg
CYLINDRICAL ALUMINUM
BATTERY AND ELECTRONICS
HOUSING.
4cm

X-SECTIONAL SCHEMATIC OF NOVA TECH RF 200

Figure 6

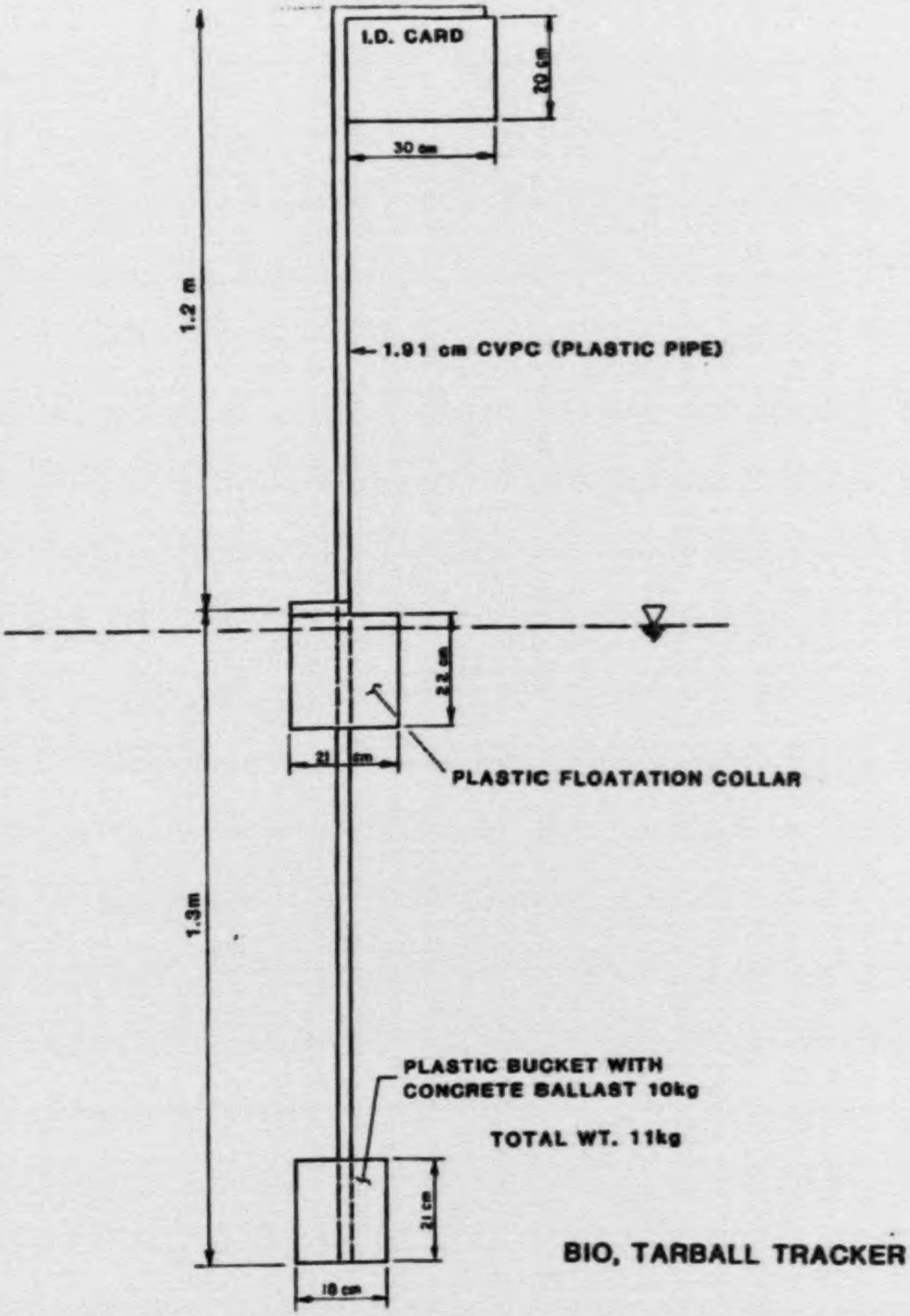

I.D. CARD
20 cm
30 cm
1.2 m
1.91 cm CVPC (PLASTIC PIPE)
22 cm
21 cm
PLASTIC FLOATATION COLLAR
1.3m
PLASTIC BUCKET WITH
CONCRETE BALLAST 10kg
TOTAL WT. 11kg
21 cm
18 cm
BIO, TARBALL TRACKER

Figure 7

4. BEDFORD BASIN TRIALS

As field work progressed, initial designs were tried, design adjustments were made, and field technique was improved. This took place within the general guidelines of: deploying and tracking groups of drifters in steady winds at or above 5 m/s; keeping within accurate tracking range; and avoiding tracking where shore and tidal effects were a concern. Most deployments were of multiple types of drifters, with usually five of any given type. One buoy type, the BIO small mast, was chosen as a 'standard' for deployment on every trial. In the end, two different ballast versions were used: 10 kg and 20 kg. Over a four year period, forty-four trials were completed, for which 36 were considered to be successful. An example of the recorded data are shown in Figures 8 and 9. Figure 8 (a copy of Figure B-6, Appendix B, original document) shows a plan view of the Bedford Basin, Trial 3, April 10, 1981. Five buoys of the medium mast type were launched in the north end of the basin. Wind was from the NW at 8.3 m/s. A total of eight positions were recorded for each of the five 'identical' medium mast buoy types over a period of about four hours. The calculated mean drift speed of the ensemble was 17.1 m/min. In Figure 9 (Figure B-8, Appendix B, original), Trial 3 speed calculations between position fixes are plotted as a function of time in minutes. In addition to the medium mast buoys, a group of BIO large mast and a group of BIO small mast buoys were also launched and tracked with the results shown. Wind speed observations are also plotted.

Table B1, Appendix B, is a tabulation of details for all trials, successful and unsuccessful, listing Trial Number, Date, Positioning System used, Types of Buoys deployed, Mean Wind Speed, and a Comments column giving the editing taken to maintain quality of data.

4.1 Position Fixing

To obtain the position of each buoy, the Hydrographic Service "Mini-Ranger' system was employed (see Anderson et al. 1973). It consists of a range finding sender/receiver for use on a work boat and two shore transponder stations at known positions. The shore stations provide an accurate base line. Four shore positions were available (see Figure 8): ED at the Fairview Cove container pier, GYP at the Canadian Gypsum pier, GRAV at the BIO finger pier, and PRINCE below the rotunda at Princess Lodge.

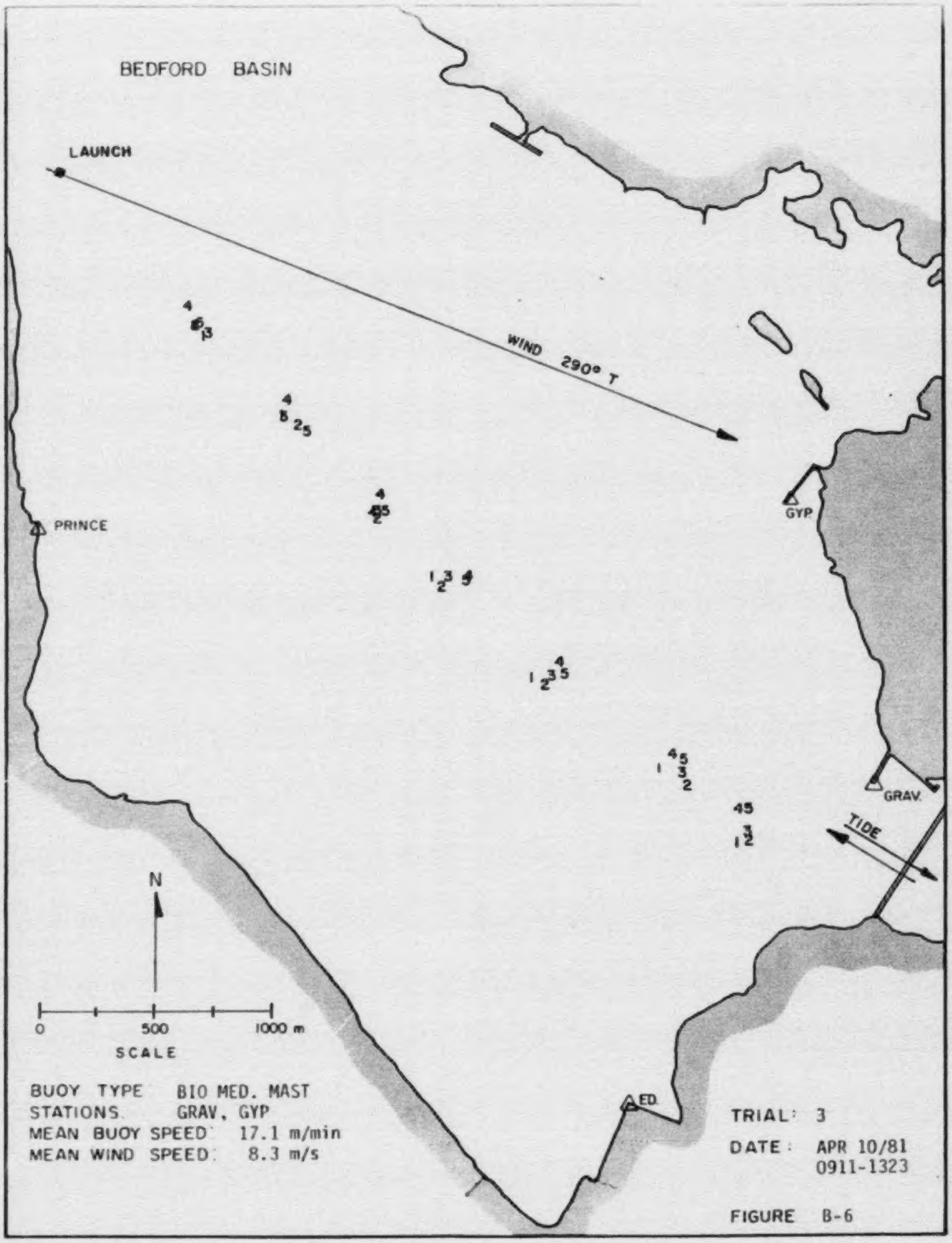

BEDFORD BASIN
LAUNCH
WIND 290° T
PRINCE
GYP
GRAV.
TIDE
ED
N
0
500
1000 m
SCALE
BUOY TYPE BIO MED. MAST
STATIONS GRAV, GYP
MEAN BUOY SPEED 17.1 m/min
MEAN WIND SPEED 8.3 m/s
TRIAL: 3
DATE: APR 10/81
0911-1323
FIGURE B-6

Figure 8: Plan view of Bedford Basin showing a typical deployment of drifters.

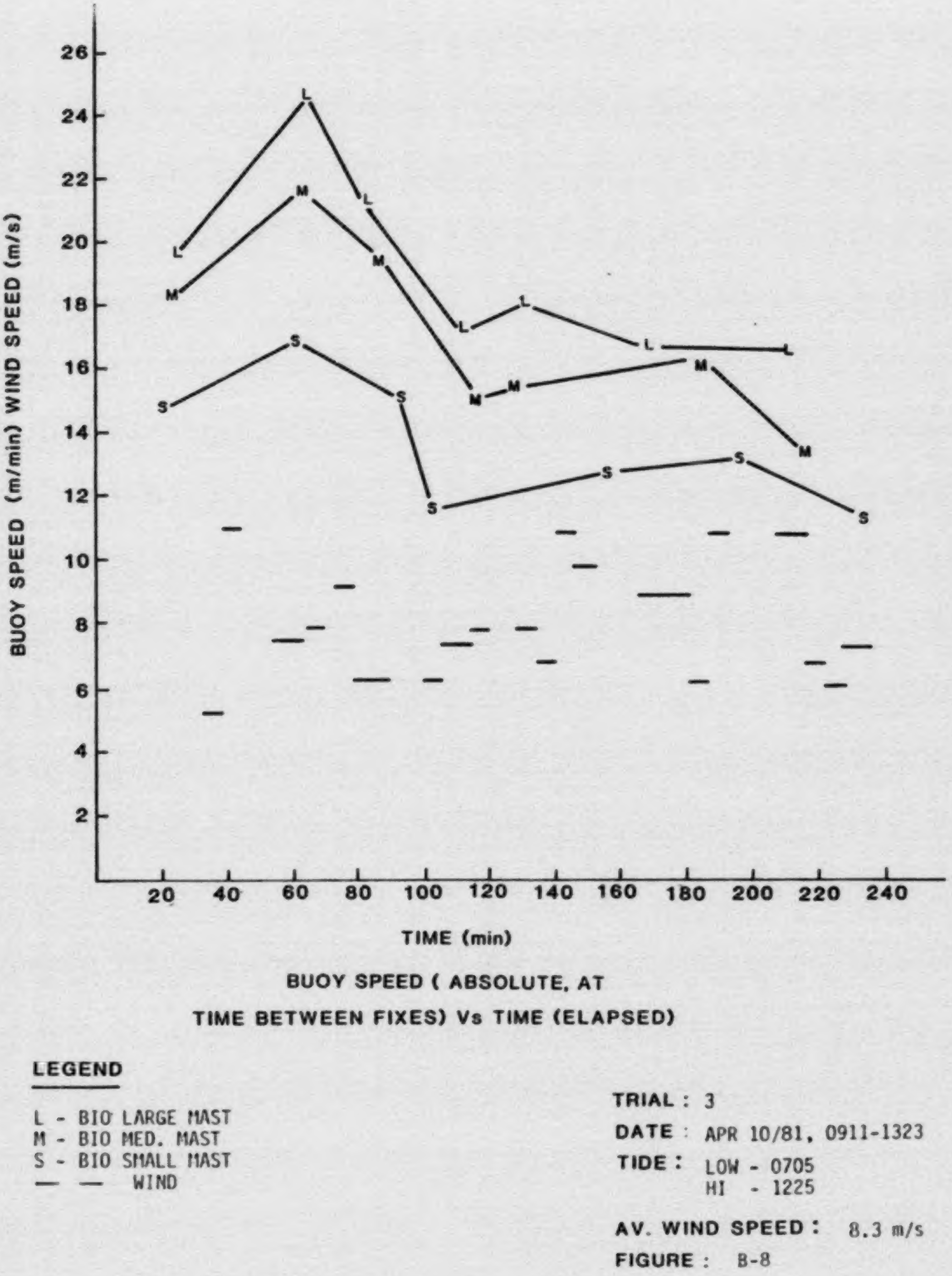


Figure 9: Time plot of wind speed and mean drift speed for the groups of drifters L, M, and S.

The choice of which two shore stations to use for a given trial depended on the wind direction. The BIO vessels used were the TUDLIK (11.3 m LOA) or SIGMA-T (14.6 m LOA). "The transponders were all pre-calibrated before the start of a particular series of trials at the BIO positioning lab. Calibration checks were often run just before and after the individual trials."

In order to record the position of a buoy, the work boat (with the sender/receiver) had to come along side. "After release [*launch*] of the buoys (always in 'slug' fashion) and the recording of the ranges at release, the vessel positioned itself downwind of the buoys. After approximately 30-45 minutes (depending on how fast the various buoys were separating) the vessel began the position taking of individual buoys by slowly steaming among them. As a rule the vessel came within seven metres of the buoys on either side of the vessel." Although not mentioned in the draft report, care was taken to not disturb the buoys with vessel wake.

The analysis of the range/range data and plotting of the results presented in Appendix B were done under contract to MacLaren Plansearch, a local contractor.

The most common editing of position data was to delete initial or final fixes of a trial because of perceived near shore effects. Contamination from tidal currents encountered near the 'narrows' of the basin was considered. Insufficient wind speed deleted the trial. These changes are noted in the Comments column of Table B1. The speed data calculated and recorded in Appendix B are for the final edited fixes.

Important for ongoing analysis is the accuracy of each fix. Errors inherent in a calibrated Mini-Ranger system are ± 1 m according to the User's Manual. For a position from two stations at right angles, this would have an expected accuracy of $\pm\sqrt{2}$ m. Larger or smaller intersection angles would have a larger error. Effort was made to keep angles near 90°, thus the estimate of total system and triangulation error is approximately ± 2 m. "The receiver/sender was located on the vessel at the approximate transverse and longitudinal mid-ship. During position fixing, the vessel (mid-ship) came within ± 7 m of the buoy. The largest error the combination of system, triangulation, and vessel location would produce for a buoy location was therefore ± 9 m. When this error is used to calculate buoy velocity there is a worst case when the two positions have opposite + 9 m or – 9 m errors for a total error of + 18 m or -18 m. This combined error would affect the calculated speed accuracy most significantly when the distance of separation of the two positions was small, e.g., a short time interval between fixes and/or a slow buoy speed." The time of each fix is given to the nearest minute. Thus the maximum error in total time between two fixes would be ± 2 min. For these data, combined estimated worst case values can be ± 16 %. A more typical expected worst case is ± 4%.

4.2 Wind and Tide data

Wind speed was measured using a cup anemometer mounted on a 10 m pole affixed to the work vessel. Readings were taken every 5 minutes. These readings are plotted on the time graphs for each trial, see e.g. Figure 9. The calibration was checked and expected to be ± 1%. Vessel motion would degrade the measurement through over-speeding and angular response problems. A conservative estimate for accuracy is ± 0.5 m/s.

The wind direction shown on the plan view for each trial (see Figure 8) is from the meteorological station located at CFB Shearwater, 5 km distant. "For the majority of trials the buoys followed the Shearwater wind direction to within ±10°. If the difference between buoy drift direction and the wind speed was appreciably greater than 10°, the particular situation was studied to investigate the causes. If the cause of the difference appeared to be tidal in nature the buoy speeds were resolved in the direction of the wind (Trials 3 and 6). If the difference was perceived to be due to the remotely measured Shearwater wind direction not accurately representing the local Basin wind direction, the buoy speeds were left unresolved."

The potential for influence from tidal flow was monitored for all trials. Shown on the plan view for each trial, e.g. Figure 8, are arrows indicating tidal flow direction at the narrows. Time of high and low are given on the time series plots (see e.g. Figure 9). Table B1 covers detail of editing due to tidal influence.

5. OFFSHORE TRIALS

With the intention of conducting trials in an offshore environment similar to those undertaken in Bedford Basin, an aerial photo technique for monitoring drift rates was tested in the Bedford Basin, Trials 4 to 7, of which three were successful. This technique was later used for two trials held off the mouth of Halifax Harbour, Trials 29 and 30, with one successful. The data from the successful trials are shown in Appendix B in a format similar to the others.

5.1 Air Photo Positioning

After initial trial runs, the following method was adopted for collecting a mosaic of air photos using a helicopter mounted camera:

- following initial release of the buoys, the deploying vessel took a position, head to wind, approximately 200 metres cross wind and mid-way along the line of buoys. The vessel was the reference for the mosaic (flying at 610 m). This was repeated at about 30 minute intervals.

- the vessel recorded wind speed and compass heading at five minute intervals while on station. For the offshore trials the reference vessel was the CCG Alert (71 m LOA). The Alert's tender did the launch of the buoys. Precautions were taken to avoid propeller wash. Alert's anemometer is located 24 m above sea level. Cups were last checked in September 1980.

The following steps were used to analyse the photos:

- 50 mm slides were projected onto paper onto which the position of the buoys and the vessel could be marked.

- the average centre of mass for each buoy type (usually consisting of five buoys) was found by averaging the x and y coordinates from each buoy.

- one buoy type was chosen as a reference. The length of time between photos and displacements of centres of mass was used to calculate the relative speeds.

Accuracy of the air photo method was considered adequate. Photo distortion from the wide angle camera (Hasselblad 50mm) and from the slide projector were considered to not be significant. Plotting accuracy was about ± 0.25 mm. The only successful offshore trial, Trial 29, had a slow separation speeds of about 0.65 m/min where the possible maximum error was ± 0.1 m/min. The Bedford Basin speeds were higher, typically 1 to 3 m/min and of longer duration.

5.2 Oil Slick Trials

In September, 1983, the Canadian Offshore Aerial Applications Task Force (COAATF) – an oil company sponsored group – conducted oil slick dispersant trials off the mouth of Halifax Harbour. During the trials, five of the BIO experimental buoys were deployed in each control slick. The buoys deployed were all small mast, full depth, 30 kg buoys, S^2. Using aerial photos, the slick, as shown by a sketched outline, and buoy positions are presented as figures in Appendix C. In all cases the buoys retained a fixed position relative to the slick outline. This is, however, a limited test of tracking capability given the light winds and short time of the observations. Average wind speed for these trials as measured at nearby Shearwater meteorological station were: September 12, 1400-1600, 15 kph from 330°; September 16, 1130-1345, 10 kph from 340°; and September 17, 1200-1500, 18 kph from 150°.

6. REFERENCES

Anderson, N.M., Coldham, F.A., Popejoy, R.D., and Woods, M.V. 1973. An Evaluation of the Mini-Ranger Positioning System. Pacific Marine Science Report 73-11. http://www.dfo-mpo.gc.ca/Library/54804.pdf.

Drozdowski, A., Horne, E., and Page, F. 2018. Hydrographic measurements near the greater Port Hawkesbury area. Can. Tech. Rep. Fish. Aquat. Sci. 29XX: viii + ??p.

White, W.D., Elliott, J.A. and Lawrence, D.J. 1983. Field Trials of Lagrangian Drifters for Tracking Oil. Unpublished manuscript. OERD Library, BIO Library, Dept. Fisheries and Oceans, Dartmouth, Nova Scotia.

APPENDIX A

This appendix provides more detail on the buoys/drifters shown in Figure 1. The BIO Barrel Drifter, Figures 1 & 2 (described in the text), was used as a full depth barrel (77.5 cm) with three different mast (antenna) diameters, and with three variations of ballast (10, 20, or 30 kg). The initial seven trials with 10 kg ballast showed it to have too much heave and pitch. Subsequent trials using a heavier ballast of 20 kg and then 30 kg solved the problem. Shown in Table A1 are results from a measurement of the period of tilt and heave when displaced from rest in a test tank. The additional ballast for the BIO Barrel Drifter changed tilt from 14 seconds to about 2, and heave from 6 seconds to about 2.5. Table A1 also includes the results for the other types of buoys included in these Trials, i.e. shallower depth BIO Barrel and the Commercial drifters. All exhibited results similar to the BIO Barrel Drifter with heavier 20 kg ballast.

Testing BIO Barrel drifters with four different mast configurations allowed comparison on varying wind drag. For the purpose of analysis and comparison, the ratio of cross-sectional area of above water and below water for all types involved are given in Table A2. For definitions of the code used to designate each BIO Barrel buoy type, see Section 2. The BIO Barrel Drifter for all types was ballasted to have the barrel rim approximately 2 cm above water. The cross-sectional area of the rim above the water is not included in the figures in Table A2. The Nova Tech drifter has an on-water skirt; it is not in the area calculations. The vane at top of the Tarball drifter was not included.

Table A1

Buoy Resonance Period
(seconds)

Buoy type	Weight	Tilt	Heave
S BIO small mast	10 kg	14	≈6
M BIO medium mast	10 kg	14	≈6
L BIO large mast	10 kg	14	≈6
S^1 BIO small mast	20 kg	2.5	3
M^1 BIO medium mast	20 kg	3	2.5
L^1 BIO large mast	20 kg	2.5	2.5
S/2 BIO small mast ½ depth	10 kg	2	2
S/4 BIO small mast ¼ depth	10kg	1.5	2
Nova Tech		< 1	< 1
Orion Tracker		< 0.5	< 0.5
Orion 4800		0.6	2
BIO Tarball Tracker		≈12	< 1
Hermes Drifter		2	1.6

Table A2

Cross-sectional Area

Buoy	Height (cm)	Depth (cm)	X-section air A_a (cm^2)	X-section water A_w (cm^2)	A_a/A_w
BIO Barrel large mast (L, L^1, L^2)	59.5	77.5	1739	3410	0.51
BIO Barrel medium mast (M, M^1, M^2)	59.5	77.5	656	3410	0.19
BIO Barrel small mast (S, S^1, S^2)	59.5	77.5	145	3410	0.043
BIO Barrel no mast (X, X^1, X^2)	0	77.5	0	3410	0
BIO Barrel half depth ($S/2, S^1/2$)	59.5	39	145	1705	0.085
BIO Barrel quarter depth (S/4)	59.5	20	145	853	0.17
Hermes (88 kg)	88	100	2930	3350	0.87
Orion 4800 (13.5 kg)	49	26	110	715	0.15
Orion Tracker (1.5 kg)	10	6	95	118	0.81
Nova Tech (1.2 kg)	48.5	35	22	226	0.10
Tarball (11 kg)	122	128	236	885	0.27

APPENDIX B

Table B is the scanned reproduction of data collected in the 1980s field trials as reported in White et al. (1983). Forty-six field trials were conducted in the period March 1981 to March 1985. The initial part, Appendix B1 (Table B1 in the original document), is a summary for each trial listing significant variables, such as date and type of buoys launched, and providing comments on results. The second part, Appendix B2, consists of figures B-1 to B-203 showing the field data for each of the thirty–six successful trials as 1) plan view diagrams showing fixes for each buoy and 2) time series velocity plots for each Trial.

TABLE B1

TRIAL NO.	DATE	POSITIONING SYSTEM	TYPES OF BUOYS	MEAN WIND SPEED	COMMENTS
A.	MAST SIZE TRIALS				
1	Mar. 25/81	Mini-Range	3L, 3M, 3S		Unsuccessful; large tidal effect
2	Apr. 3/81	Mini-Range	3L, 3M, 3S	6.2	Successful
3	Apr. 10/81	Mini-Range	5L, 5M, 5S	8.3	Successful
4	Sep. 21/81 am	air-photo	5L, 5M, 5S	7.0	Successful
5	Sep. 21/81 pm	air-photo	5L, 5M, 5S		Unsuccessful; too many photos without complete sets of buoys

TABLE B1 (cont'd)

TRIAL NO.	DATE	POSITIONING SYSTEM	TYPES OF BUOYS	MEAN WIND SPEED	COMMENTS
6	Nov. 9/81 am	air-photo	5L, 5M, 5S	7.4	Successful; edit of boundary influenced data
7	Nov. 9/81 pm	air-photo	5L, 5M, 5S	7.5	Successful; edit of boundary influenced data
B.	COMMERCIAL BUOY TRIALS				
8	Jan. 8/82 am	Mini-Range	5 Orion Tracker 5 Nova Tech, 5S	8.1	Successful; edit of boundary influenced data
9	Jan. 8/82 pm	Mini-Range	5 Orion Tracker 5 Nova Tech, 5S	8.4	Successful; edit of boundary influenced data
10	Jan. 13/82 am	Mini-Range	3 Hermes, 4 Tar B., 3 Orion 4800, 5 Orion Tracker, 5S	5.2	Unsuccessful; winds light and strong tidal influence
11	Jan. 13/82 pm	Mini-Range	3 Hermes, 4 Tar B., 3 Orion 4800, 5 Orion Tracker, 5S	5.6	Successful
12.	Mar. 2/82 am	Mini-Range	3 Hermes, 3 Tar B., 3 Orion 4800, 5 Orion Tracker, 5S	6.9	Successful
13	Mar. 3/82 am	Mini-Range	3 Hermes, 3 Tar B., 1 Orion 4800, 5 Orion Tracker, 5 Nova T., 5S	7.8	Successful
14	Mar. 3/82 pm	Mini-Range	3 Hermes, 3 Tar B., 1 Orion 4800, 5 Orion Tracker, 5 Nova T., 5S	7.8	Successful

TABLE B1 (cont'd)

TRIAL NO.	DATE	POSITIONING SYSTEM	TYPES OF BUOYS	MEAN WIND SPEED	COMMENTS
15	Mar. 11/82 am	Mini-Range	3 Hermes, 4 Tar B., 3 Orion 4800, 5 Orion Tracker, 5 Nova T, 5S	6.5	Successful
16	Mar. 11/82 pm	Mini-Range	3 Hermes, 2 Tar B., 3 Orion 4800, 5 Orion Tracker, 5 Nova T., 5S	7.8	Successful
C.	STABILITY TRIALS				
17	May 26/82 am	Mini-Range	5L[1], 5M[1], 5S[1], 5S	<5	Unsuccessful; trial winds too light, 10 kg buoys floating with slight tilt
18	May 26/82 pm	Mini-Range	5L[1], 5M[1], 5S[1], 5S	7.1	Successful; 10 kg buoys floating with slight tilt
19	May 27/82 am	Mini-Range	5L[1], 5M[1], 5S[1], 5S	6.4	Successful; somewhat close to shore
20	May 27/82 pm	Mini-Range	5L[1], 5M[1], 5S[1], 5S	8.3	Unsuccessful; wind shift during trial
D.	CHANGE IN DEPTH TRIALS				
21	June 2/82 am	Mini-Range	5S/2, 5S/4, 5X 5S	6.5	Successful; close to shore (foggy)
22	June 2/82 pm	Mini-Range	5S/2, 5S/4, 5X 5S	6.4	Successful
23	June 3/82 am	Mini-Range	4S/2, 5S/4, 5X 5S	7.5	Successful
24	June 3/82 pm	Mini-Range	4S/2, 5S/4, 5X 5S	8.8	Successful

TABLE B1 (cont'd)

TRIAL NO.	DATE	POSITIONING SYSTEM	TYPES OF BUOYS	MEAN WIND SPEED	COMMENTS
E. STABILITY TRIALS					
25	Oct. 6/82 am	Mini-Range	5L', 5M', 5S', 5S	6.0	Successful; start close to shore
26	Oct. 6/82 pm	Mini-Range	5L', 5M', 5S' 5S	6.0	Successful; start close to shore
27	Oct. 7/82 am	Mini-Range	5L', 5M', 5S' 5S	7.4	Successful
28	Oct. 7/82	Mini-Range	5L', 5M', 5S' 5S	7.2	Successful
F. OFFSHORE TRIALS					
29	Nov. 18/82 am	air-photo offshore	5L, 5M, 5S, 5X	6.5	Successful; speeds somewhat slower than expected
30	Nov. 18/82 pm	air-photo offshore	5L, 5M, 5S, 5X	<5	Unsuccessful; winds light
G. STABILITY TRIALS					
31	Feb. 6/84 pm	Mini-Range	5 L^2, 5 M^2, 5 S^2, 5 S^1, 5 S, 4 X^2, 5 X^1	9.3	Successful
32	Feb. 8/84 am	Mini-Range	5 L^2, 5 M^2, 5 S^2, 5 S^1, 5 S, 5 X^2, 5 X^1	3.7	Unsuccessful; winds light
33	Feb. 8/84 pm	Mini-Range	5 L^2, 5 M^2, 5 S^2, 5 S^1, 5 S, 5 X^2, 5 X^1	4.4	Unsuccessful; winds light
34	Feb. 9/84 am	Mini-Range	5 L^2, 5 M^2, 5 S^2, 5 S^1, 5 S, 5 X^2, 5 X^1	6.8	Unsuccessful; Icing on buoy masts
35	Feb. 15/84 am	Mini-Range	5 L^2, 5 M^2, 5 S^2, 5 S^1, 5 S, 5 X^2, 5 X^1	4.3	Unsuccessful; winds light

TABLE B1 (cont'd)

TRIAL NO.	DATe	POSITIONING SYSTEM	TYPES OF BUOYS	MEAN WIND SPEED	COMMENTS
H.	**MAST SIZE TRIALS**				
36	Feb. 22/84 am	Mini-Range	5 $L^1/2$, 5 $M^1/2$, 5 $S^1/2$, 5 S^1	6.1	Successful
37	Feb. 22/84 pm	Mini-Range	5 $L^1/2$, 5 $M^1/2$, 5 $S^1/2$, 5 S^1	6.6	Successful
38	Feb. 24/84 pm	Mini-Range	5 $L^1/2$, 5 $M^1/2$, 5 $S^1/2$, 5 S^1	8.5	Successful
39	Mar. 28/84 am	Mini-Range	4 $L^1/2$, 5 $M^1/2$, 5 $S^1/2$, 5 S^1	9.4	Successful
40	Mar. 28/84 pm	Mini-Range	4 $L^1/2$, 5 $M^1/2$, 4 $S^1/2$, 5 S^1	7.8	Successful
I.	**STABILITY TRIALS**				
41	May 2/84 pm	Mini-Range	5 L^2, 5 M^2, 4 S^2, 5 S^1, 5 S, 4 X^2, 5 X^1	2.7	Unsuccessful; wind died in last ½ hour of trial
42	May 9/84 am	Mini-Range	5 L^2, 5 M^2, 3 S^2, 5 S^1, 5 S, 4 X^2, 5 X^1	7.2	Successful
43	Mar. 26/85 am	Mini-Range	5 L^2, 5 M^2, 5 S^2, 5 S^1, 5 S	6.0	Successful
44	Mar. 26/85 pm	Mini-Range	5 L^2, 5 M^2, 5 S^2, 5 S^1, 5 S	6.2	Successful
45	Mar. 27/85 am	Mini-Range	5 L^2, 5 M^2, 5 S^2, 5 S^1, 5 S	9.2	Successful
46	Mar. 27/85 pm	Mini-Range	5 L^2, 5 M^2, 5 S^2, 5 S^1, 5 S	9.6	Successful

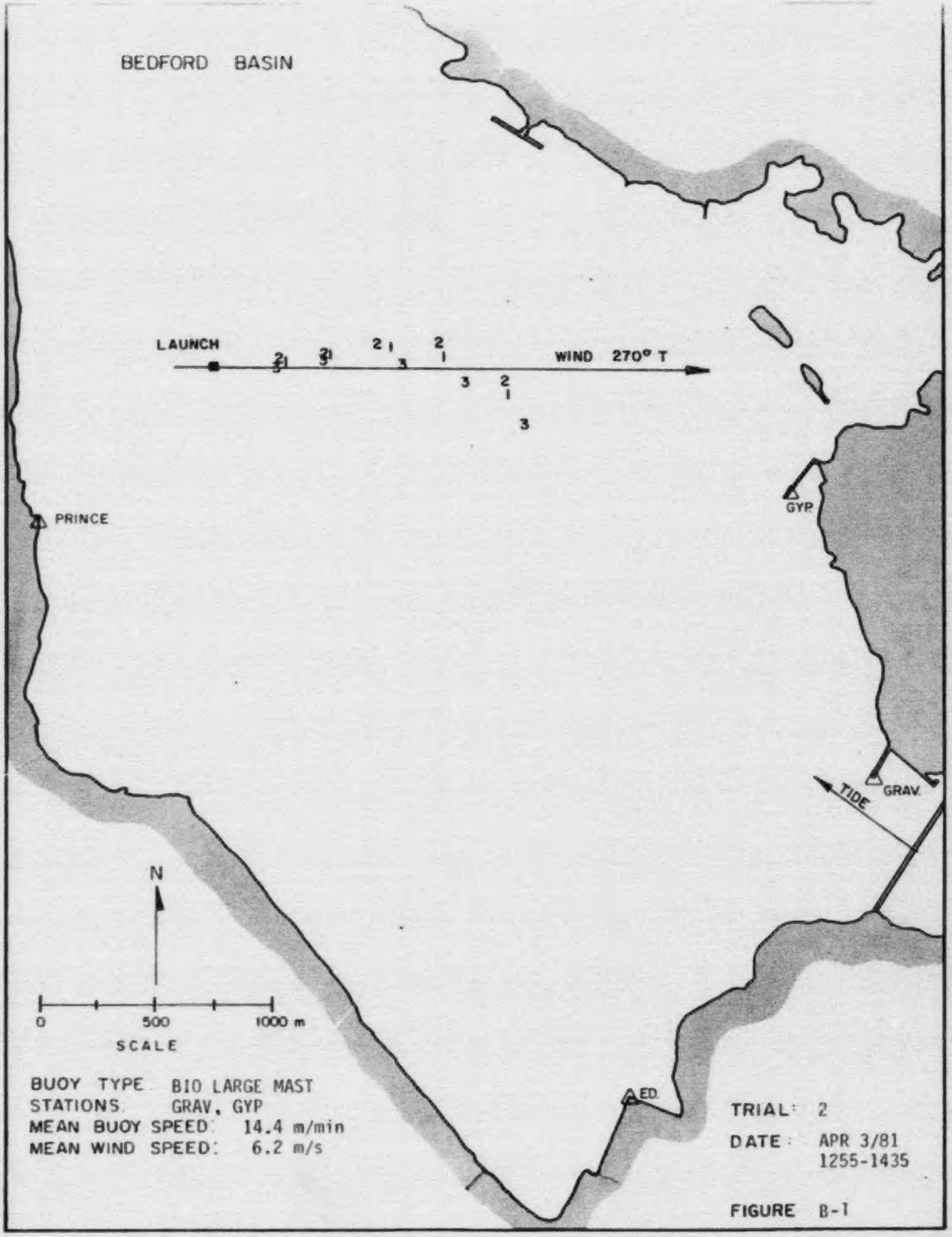
Appendix B2

Figures B-1 to B-203

Errata:

- B-134 Stn 29, at T + 51 min, the units labeled m/s should be m/min.

- B-158 Stn 38, buoy speed listed for 1/2 S as 21.4 m/min is considered to be a typo. The value does not agree with the plotted graph and is identical to the value for the buoy S. An estimate of speed from the plot is 24.3 m/min.

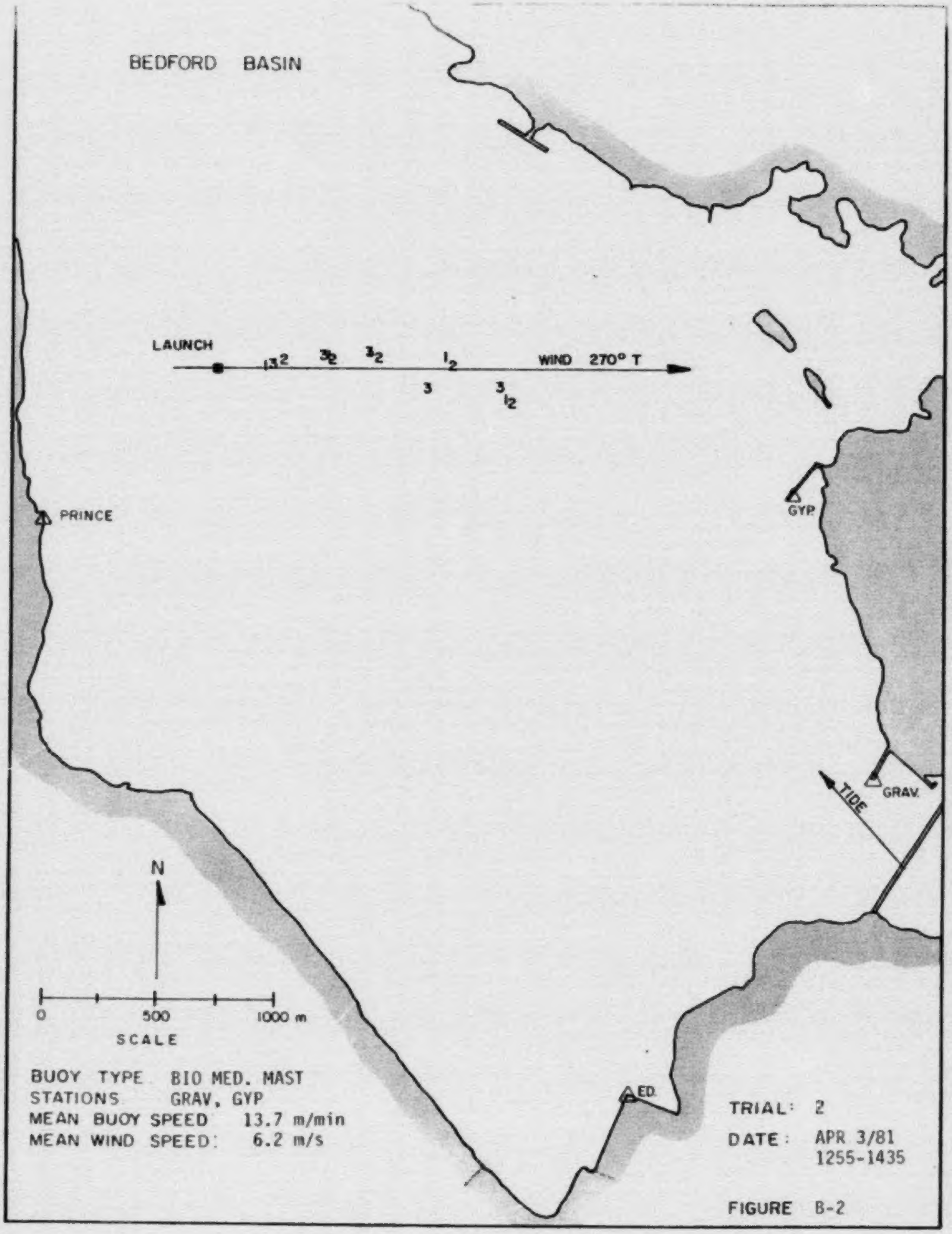

BEDFORD BASIN
LAUNCH
WIND 270° T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE BIO LARGE MAST
STATIONS GRAV, GYP
MEAN BUOY SPEED: 14.4 m/min
MEAN WIND SPEED: 6.2 m/s

TRIAL: 2

DATE: APR 3/81
1255-1435

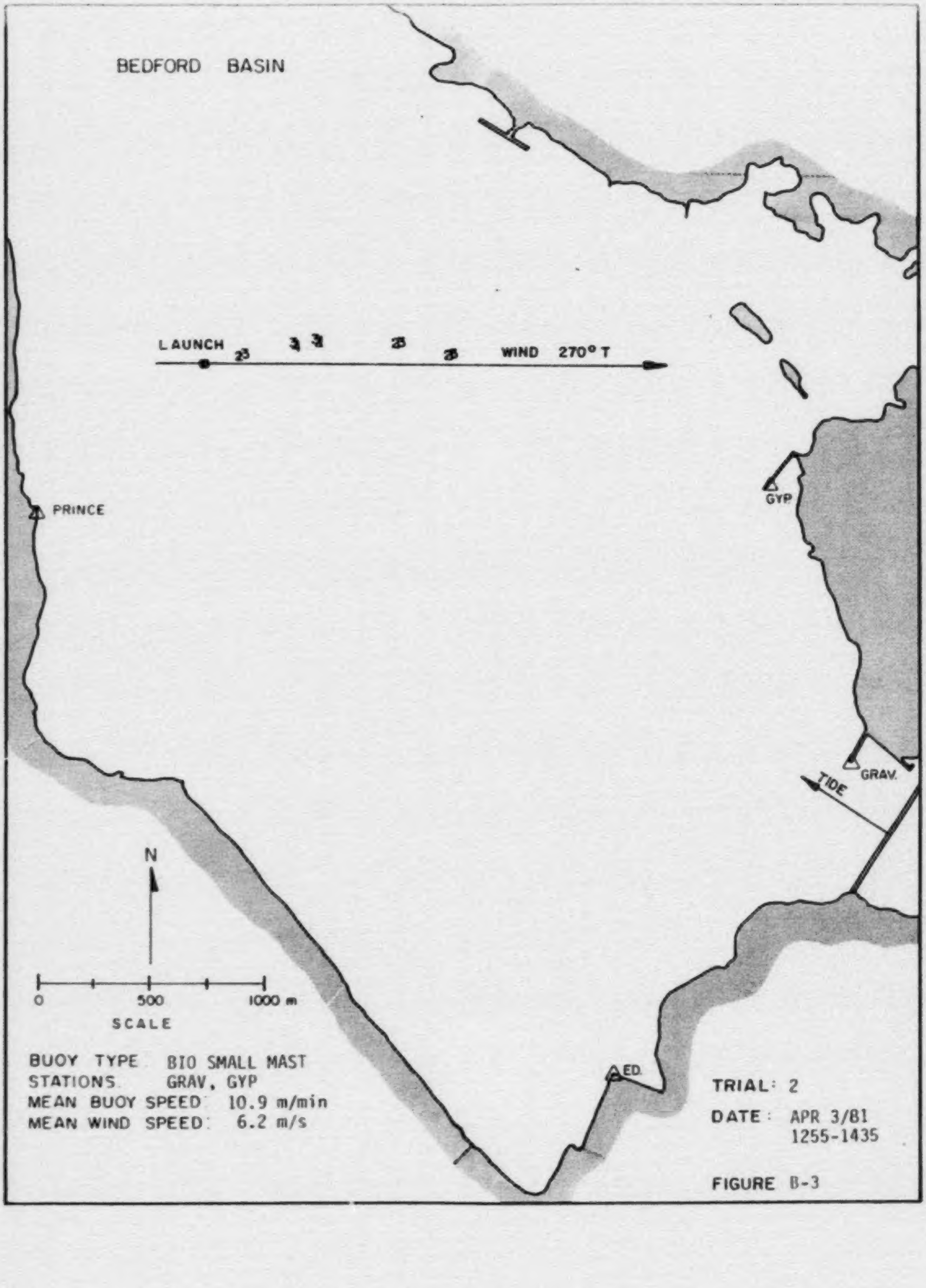
FIGURE B-1


BEDFORD BASIN
LAUNCH
132
32
32
12
3
3
12
WIND 270° T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE BIO MED. MAST
STATIONS GRAV, GYP
MEAN BUOY SPEED 13.7 m/min
MEAN WIND SPEED: 6.2 m/s

TRIAL: 2
DATE: APR 3/81
1255-1435

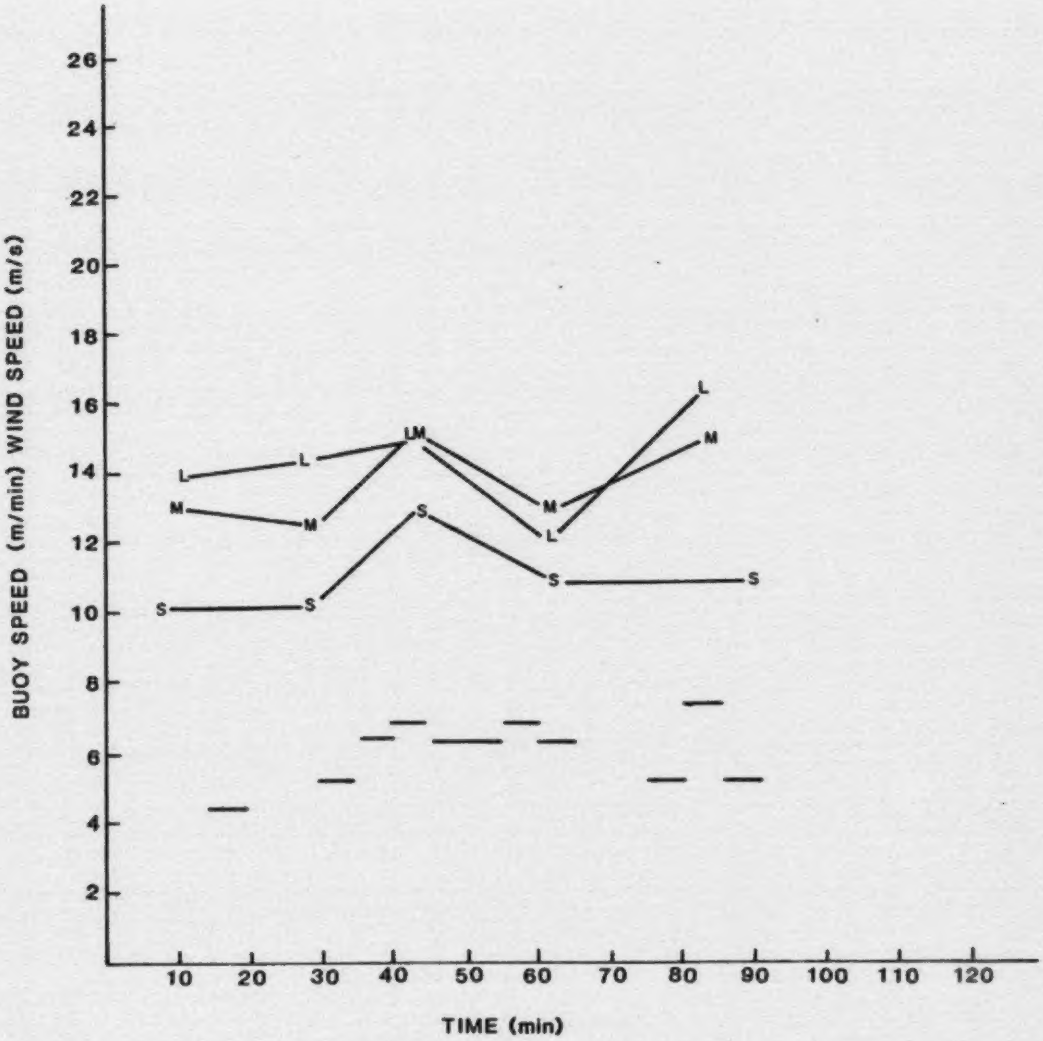
FIGURE B-2


BEDFORD BASIN
LAUNCH
23
WIND 270° T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: BIO SMALL MAST
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 10.9 m/min
MEAN WIND SPEED: 6.2 m/s

TRIAL: 2
DATE: APR 3/81
1255-1435

FIGURE B-3

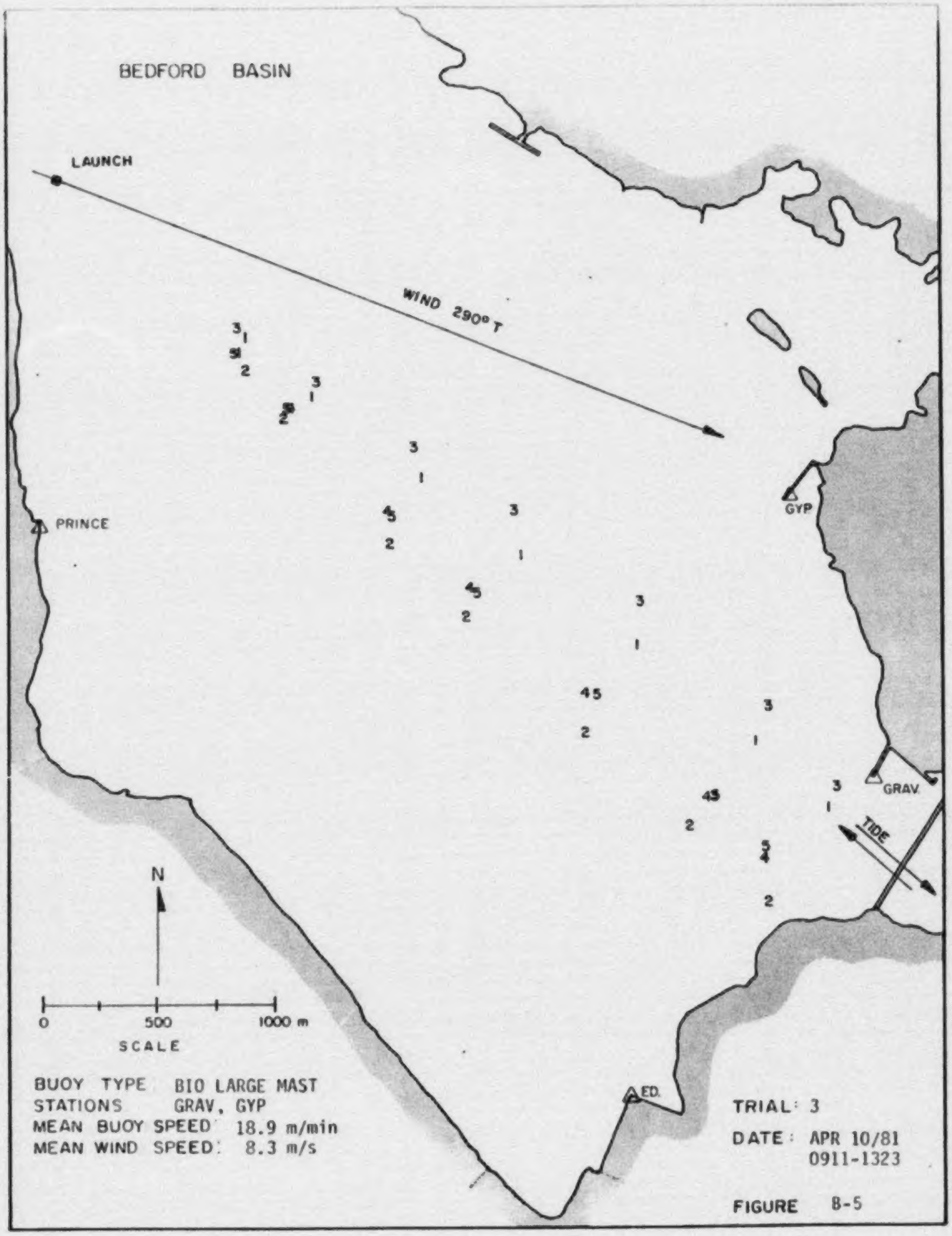


BUOY SPEED (ABSOLUTE, AT TIME BETWEEN FIXES) Vs TIME (ELAPSED)

LEGEND

L - BIO LARGE MAST
M - BIO MED. MAST
S - BIO SMALL MAST
— — WIND

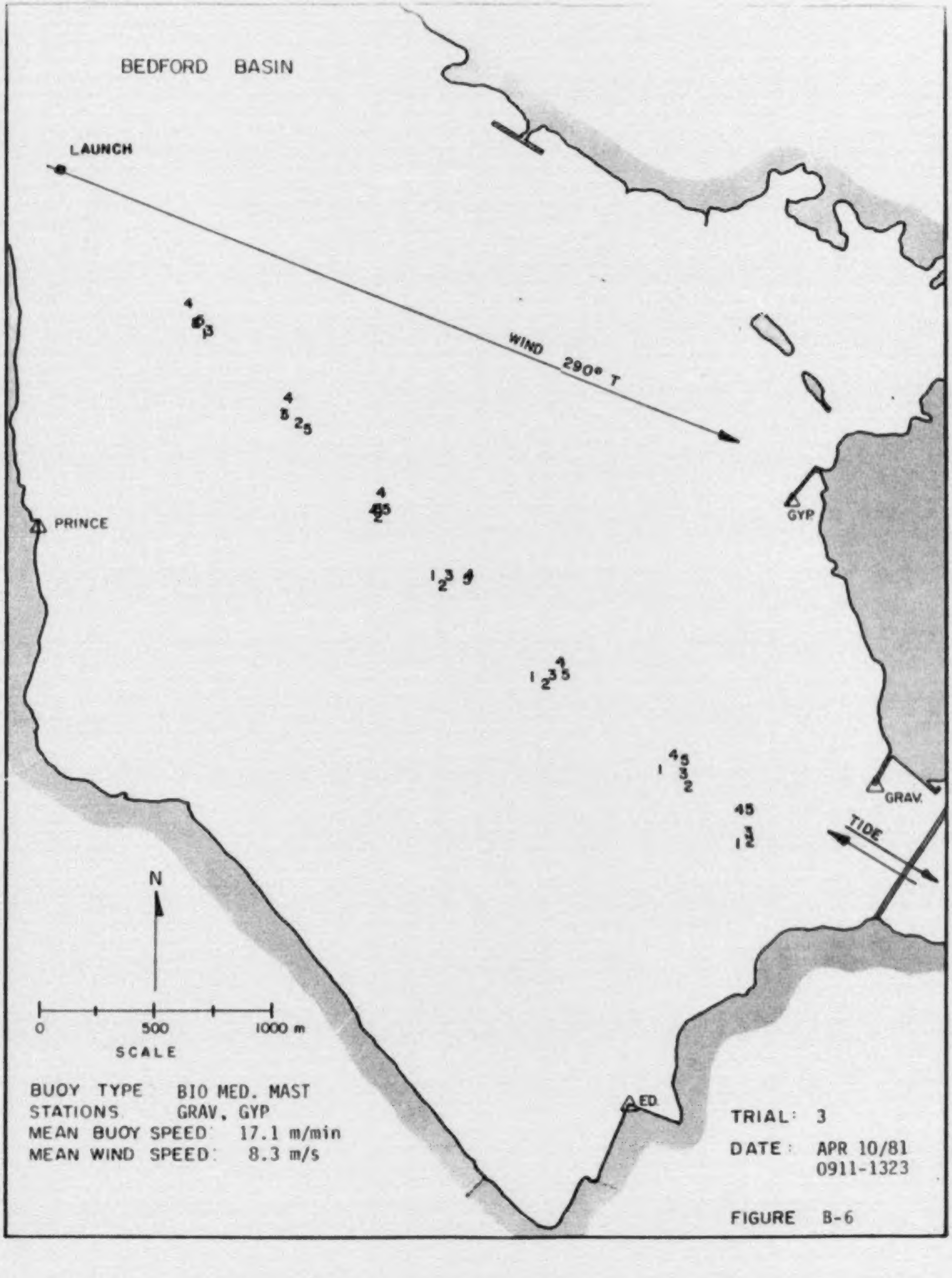
TRIAL : 2
DATE : APR 3/81, 1255-1435
TIDE : LOW - 1304
HI - 1915
AV. WIND SPEED : 6.2 m/s
FIGURE : B - 4


BEDFORD BASIN
LAUNCH
WIND 290° T
PRINCE
GYP
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE
3
1
2
45

BUOY TYPE BIO LARGE MAST
STATIONS GRAV, GYP
MEAN BUOY SPEED: 18.9 m/min
MEAN WIND SPEED: 8.3 m/s

TRIAL: 3
DATE: APR 10/81
0911-1323

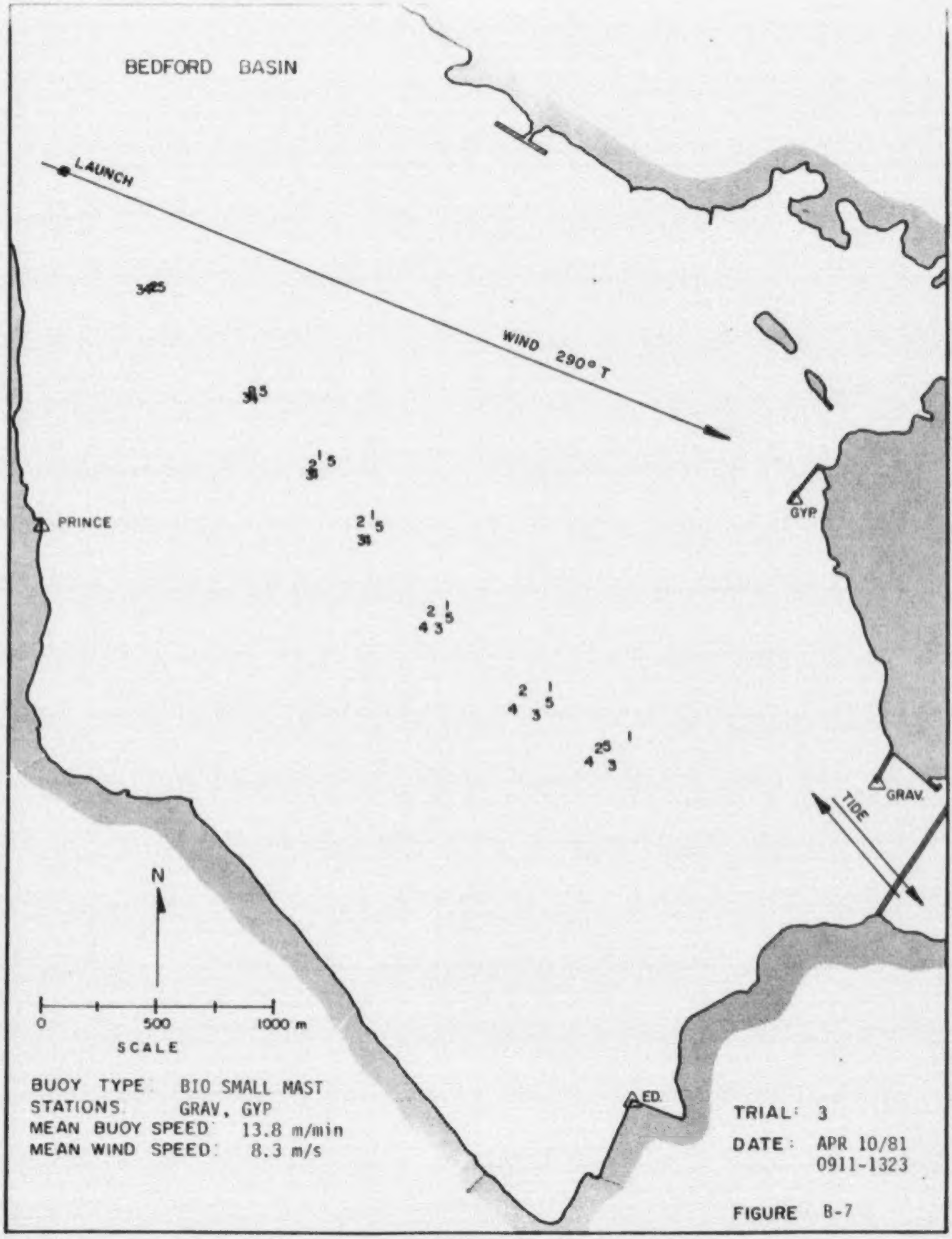
FIGURE B-5


BEDFORD BASIN
LAUNCH
WIND 290° T
PRINCE
GYP
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE BIO MED. MAST
STATIONS GRAV, GYP
MEAN BUOY SPEED: 17.1 m/min
MEAN WIND SPEED: 8.3 m/s

TRIAL: 3
DATE: APR 10/81
0911-1323

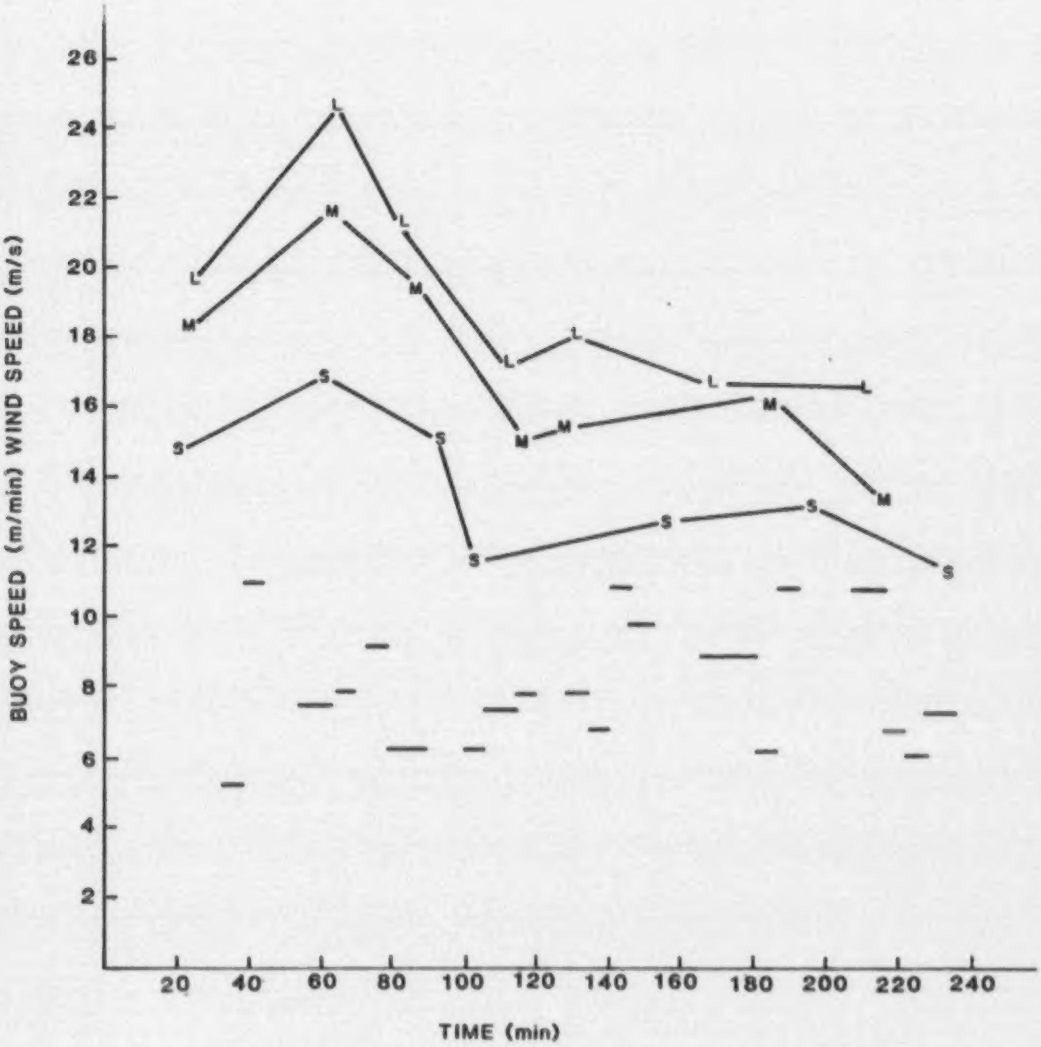
FIGURE B-6


BEDFORD BASIN
LAUNCH
WIND 290° T
PRINCE
GYP
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: BIO SMALL MAST
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 13.8 m/min
MEAN WIND SPEED: 8.3 m/s

TRIAL: 3
DATE: APR 10/81
0911-1323

FIGURE B-7



BUOY SPEED (ABSOLUTE, AT
TIME BETWEEN FIXES) Vs TIME (ELAPSED)

LEGEND

L - BIO LARGE MAST
M - BIO MED. MAST
S - BIO SMALL MAST
— — WIND

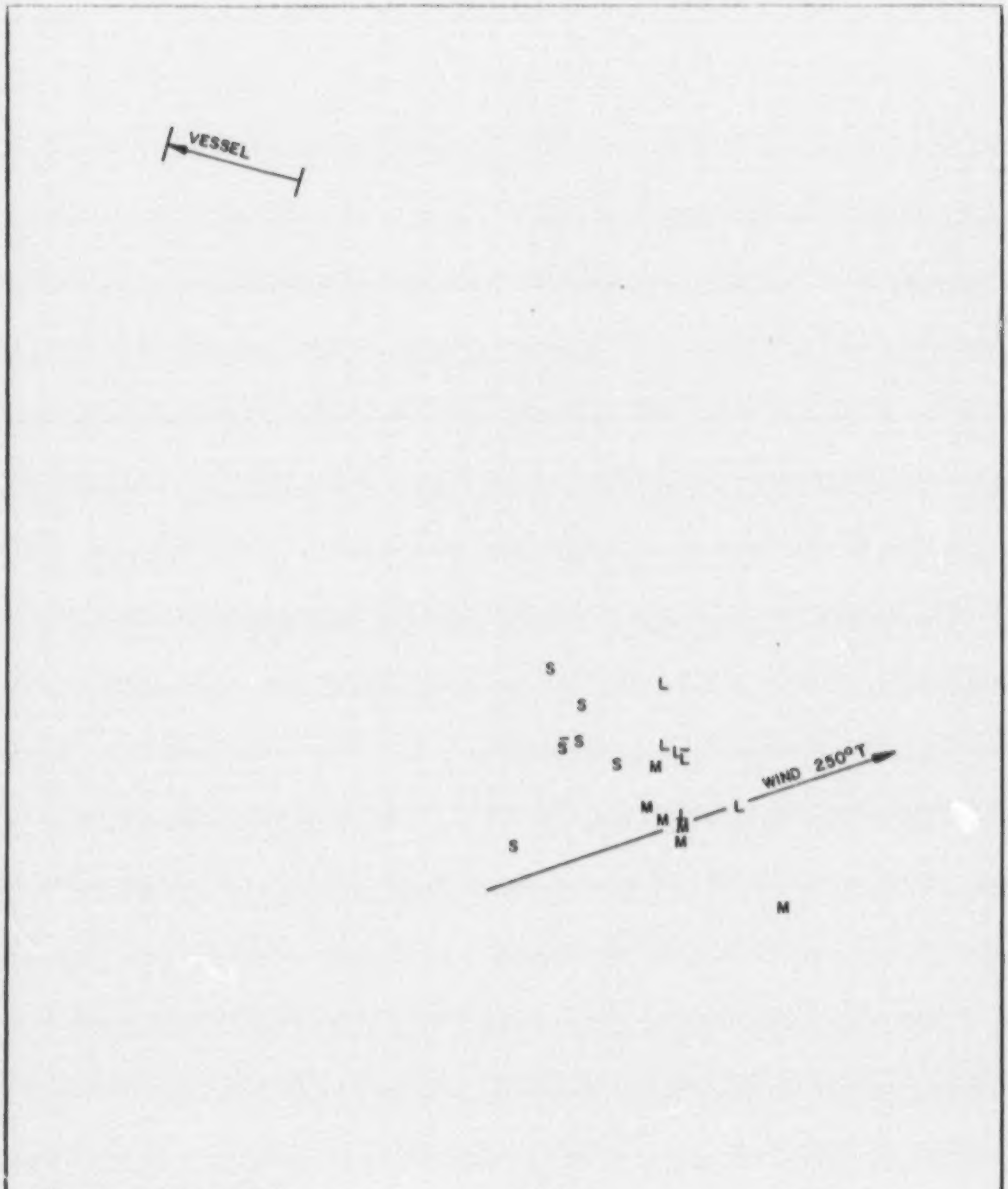
TRIAL : 3

DATE : APR 10/81, 0911-1323

TIDE : LOW - 0705
HI - 1225

AV. WIND SPEED : 8.3 m/s

FIGURE : B-8

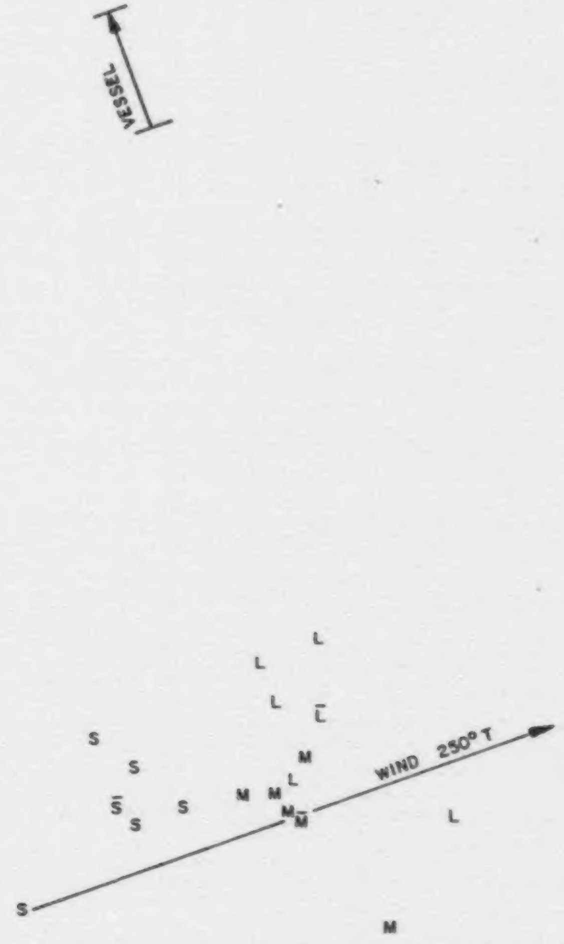


RELATIVE BUOY SPEEDS
S wrt M : N/A
L wrt M : N/A
MEAN WIND SPEED : 7.0 m/s
SCALE : VESSEL 11.3 m LOA

LEGEND

S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

TRIAL : 4
1008-1219
DATE : SEP 21/8 am
TIME : T + 1 min
FIGURE : B-9

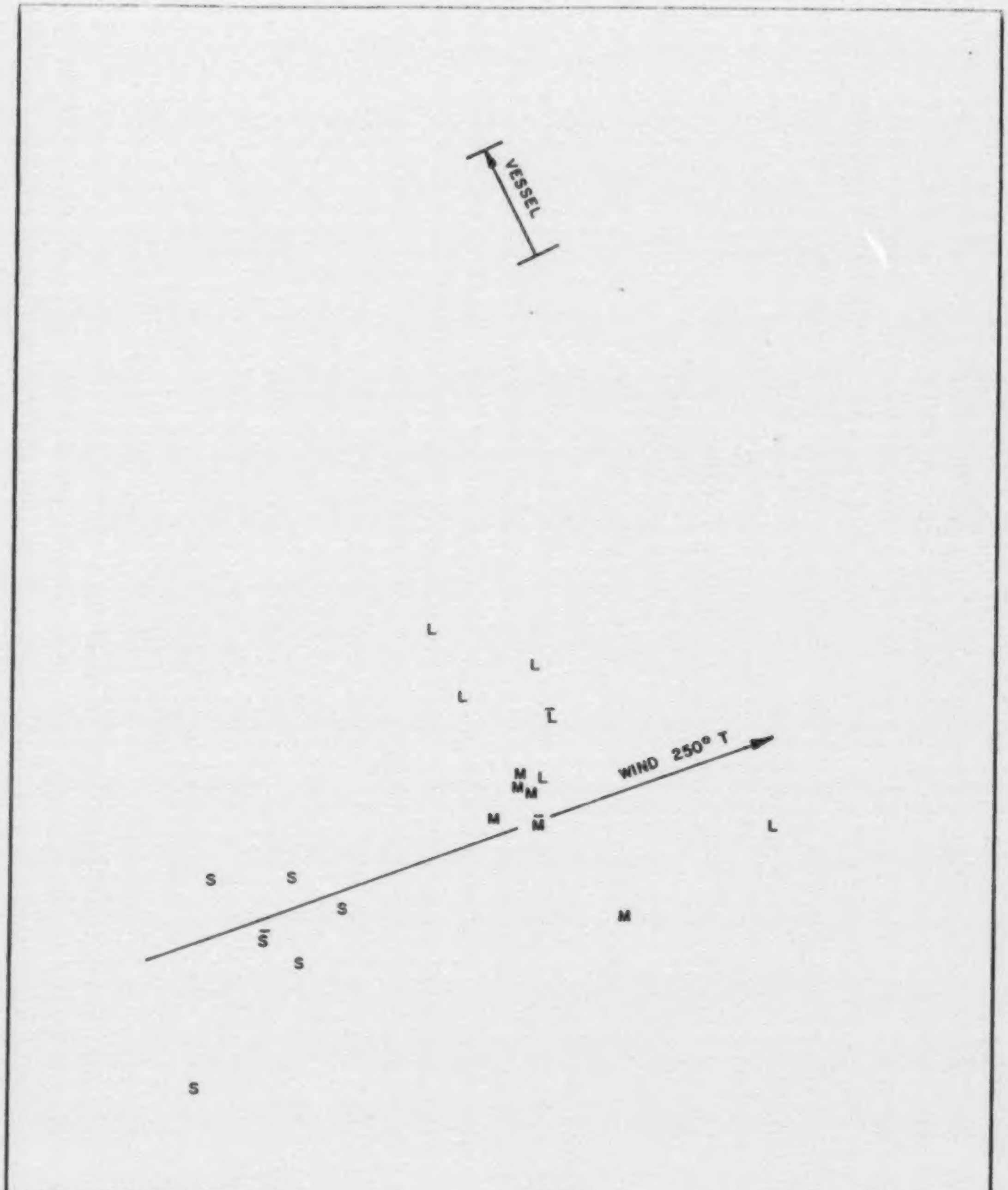


RELATIVE BUOY SPEEDS
S wrt M : 3.06 m/min
L wrt M : 0.30 m/min
MEAN WIND SPEED : 7.0 m/s
SCALE : VESSEL 11.3m LOA

LEGEND

S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

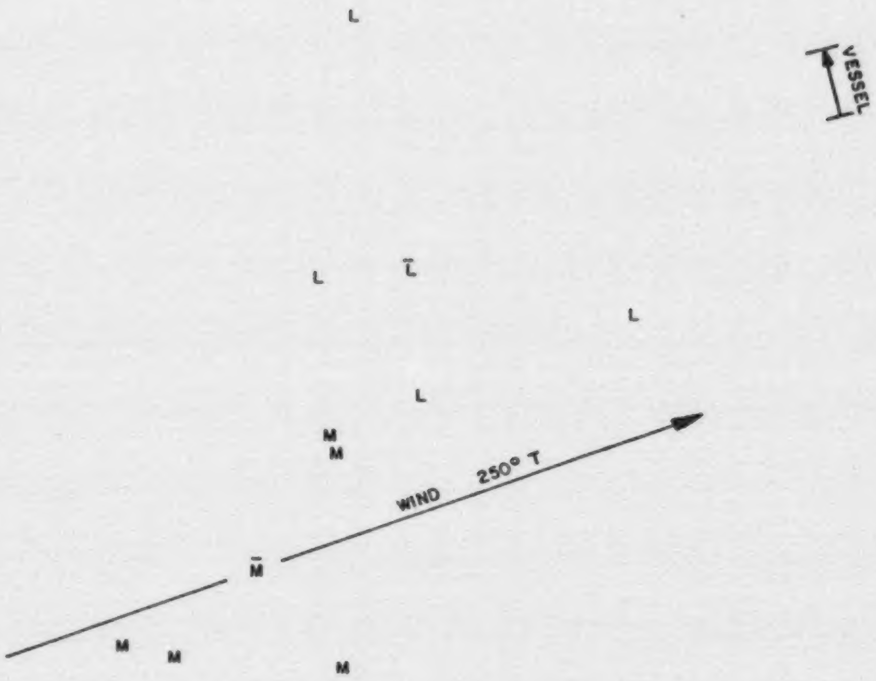
TRIAL : 4
1008-1219
DATE : SEP 21/81 am
TIME : T + 4 min
FIGURE : B-10



RELATIVE BUOY SPEEDS
S w.r.t.M : 2.82 m/min
L w.r.t.M : 0.0 m/min
MEAN WIND SPEED : 7.0 m/s
SCALE : VESSEL 11.3m LOA

LEGEND
S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

TRIAL : 4
DATE : 1008-1219 SEP 21/81am
TIME : T + 8 min
FIGURE : B-11

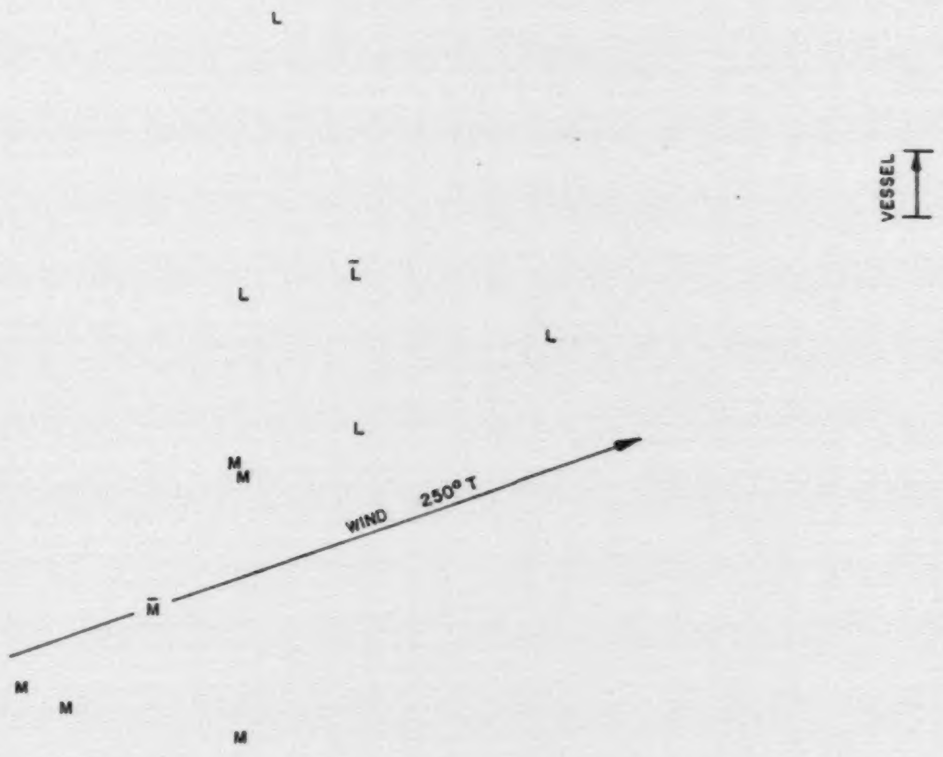


Note: One of the large mast buoys drifted off camera and is therefore not used in calculations.

RELATIVE BUOY SPEEDS
S w.r.t.M : N/A
L w.r.t.M : 0.78 m/min
MEAN WIND SPEED : 7.0 m/s
SCALE : VESSEL 11.3m LOA

LEGEND
S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

TRIAL : 4
1008-1219
DATE : SEP 21/81 am
TIME : T + 53 min
FIGURE : B-12

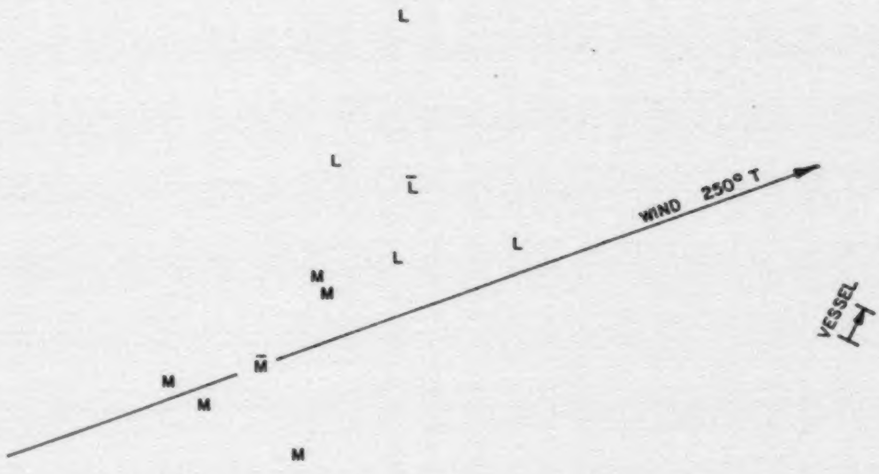


Note: One large mast buoy out of camera range and therefore not included in calculations.

RELATIVE BUOY SPEEDS
S w.r.t.M : N/A
L w.r.t.M : 2.4 m/min
MEAN WIND SPEED : 7.0 m/s
SCALE : VESSEL 11.3 m LOA

LEGEND
S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

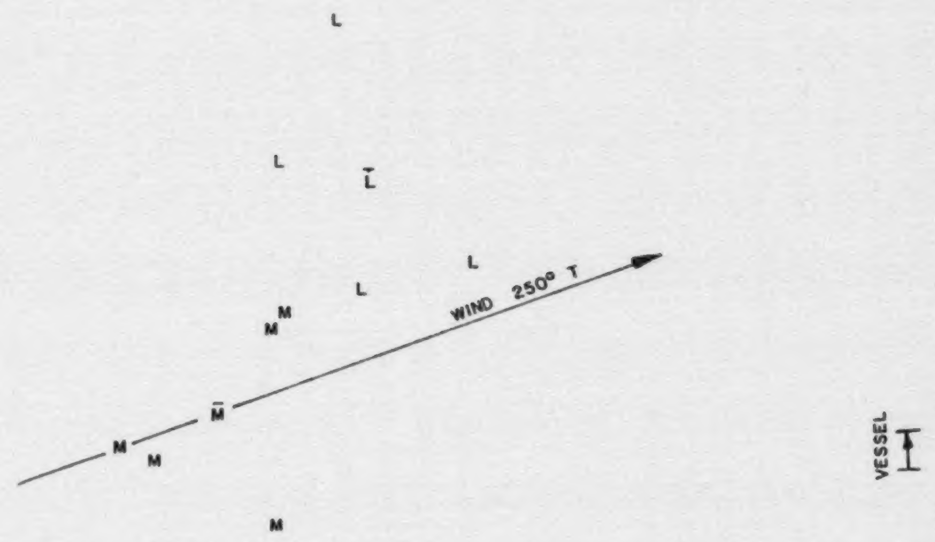
TRIAL : 4
1008-1219
DATE : SEP 21/81 am
TIME : T + 57 min
FIGURE : B-13


L
L
L̄
L
L
M
M
M̄
M
M
M
WIND 250° T
VESSEL

RELATIVE BUOY SPEEDS
S w.r.t.M : N/A
L w.r.t.M : 2.28 m/min
MEAN WIND SPEED : 7.0 m/s
SCALE : VESSEL 11.3m LOA

LEGEND
S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

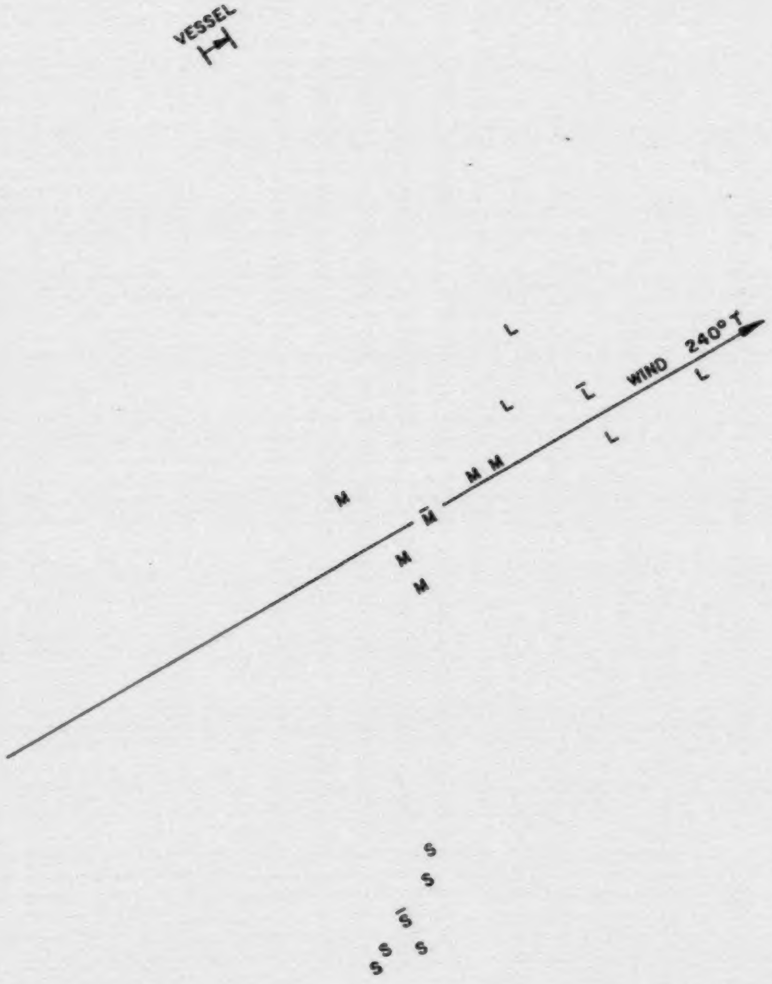
TRIAL : 4
1008-1219
DATE : SEP 21/81 am
TIME : T + 65 min
FIGURE : B-14



RELATIVE BUOY SPEEDS
S w.r.t. M : N/A
L w.r.t. M : 0.84 m/min
MEAN WIND SPEED : 7.0 m/s
SCALE : VESSEL 11.3m LOA

LEGEND
S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

TRIAL : 4
1008-1219
DATE : SEP 21/81 am
TIME : T + 71 min
FIGURE : B-15

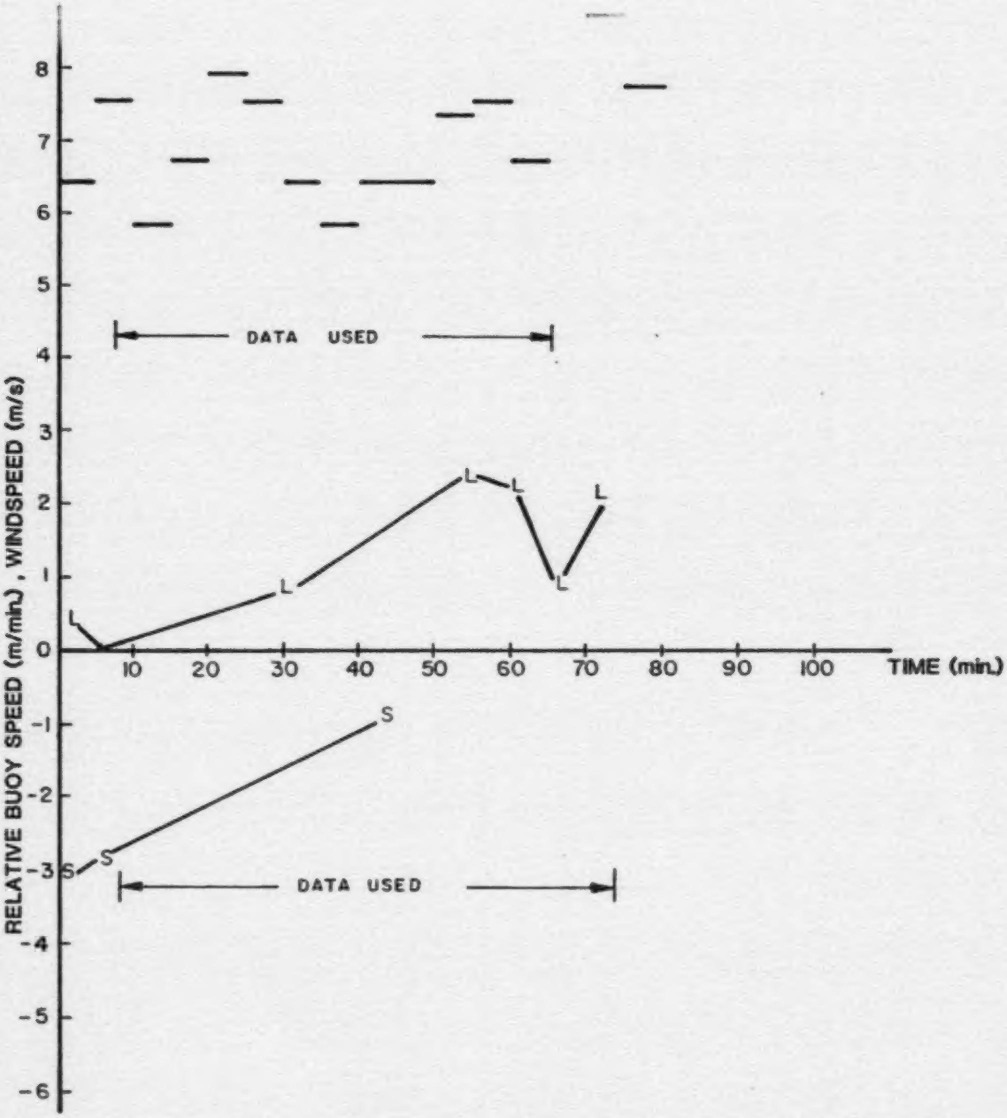

VESSEL
WIND 240° T
L
L
L̄
L
L
M M
M
M̄
M
M
S
S
S̄
S S
S
S

RELATIVE BUOY SPEEDS
S w.r.t.M : 0.9 m/min
L w.r.t.M : 2.04 m/min
MEAN WIND SPEED : 7.0 m/s
SCALE : VESSEL 11.3m LOA

LEGEND

S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

TRIAL : 4
1008-1219
DATE : SEP 21/81 am
TIME : T + 75 min
FIGURE : B-16



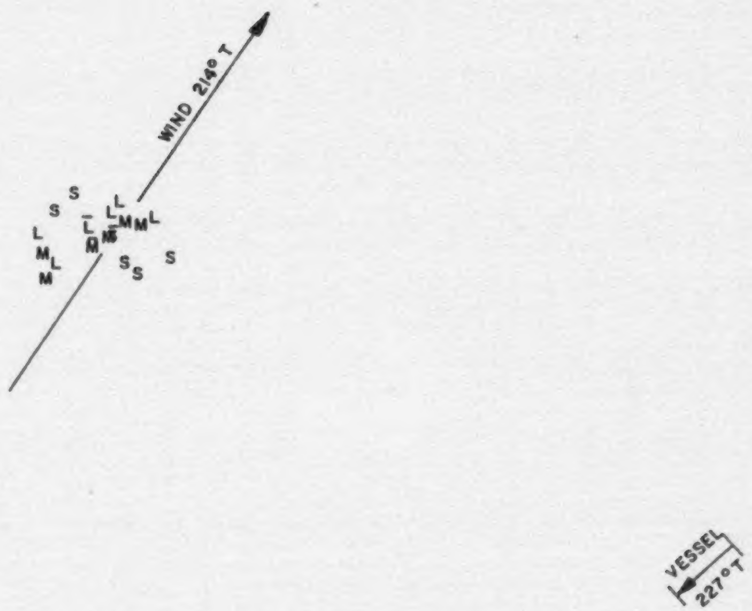
BUOY SPEED (RELATIVE, AT TIME BETWEEN FIXES)

Vs TIME (ELAPSED)

LEGEND

L - BIO LARGE MAST
S - BIO SMALL MAST
— — WIND

TRIAL: 4
DATE: SEP 21/81,
TIDE: LOW 0815, HI 1330
AV. WIND SPEED: 7.0 m/s
FIGURE: B-17

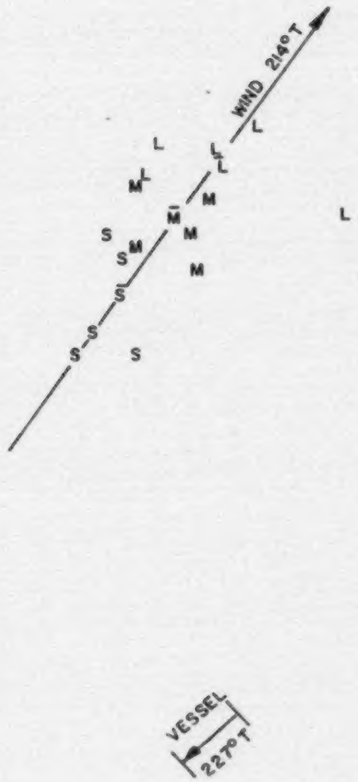


RELATIVE BUOY SPEEDS
S wrt M : N/A
L wrt M : N/A
MEAN WIND SPEED : 7.4 m/s
SCALE : VESSEL 14.6 m LOA

LEGEND

S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

TRIAL : 6
1010-1230
DATE : Nov 9/81 am
TIME : T + 7 min
FIGURE : B-18

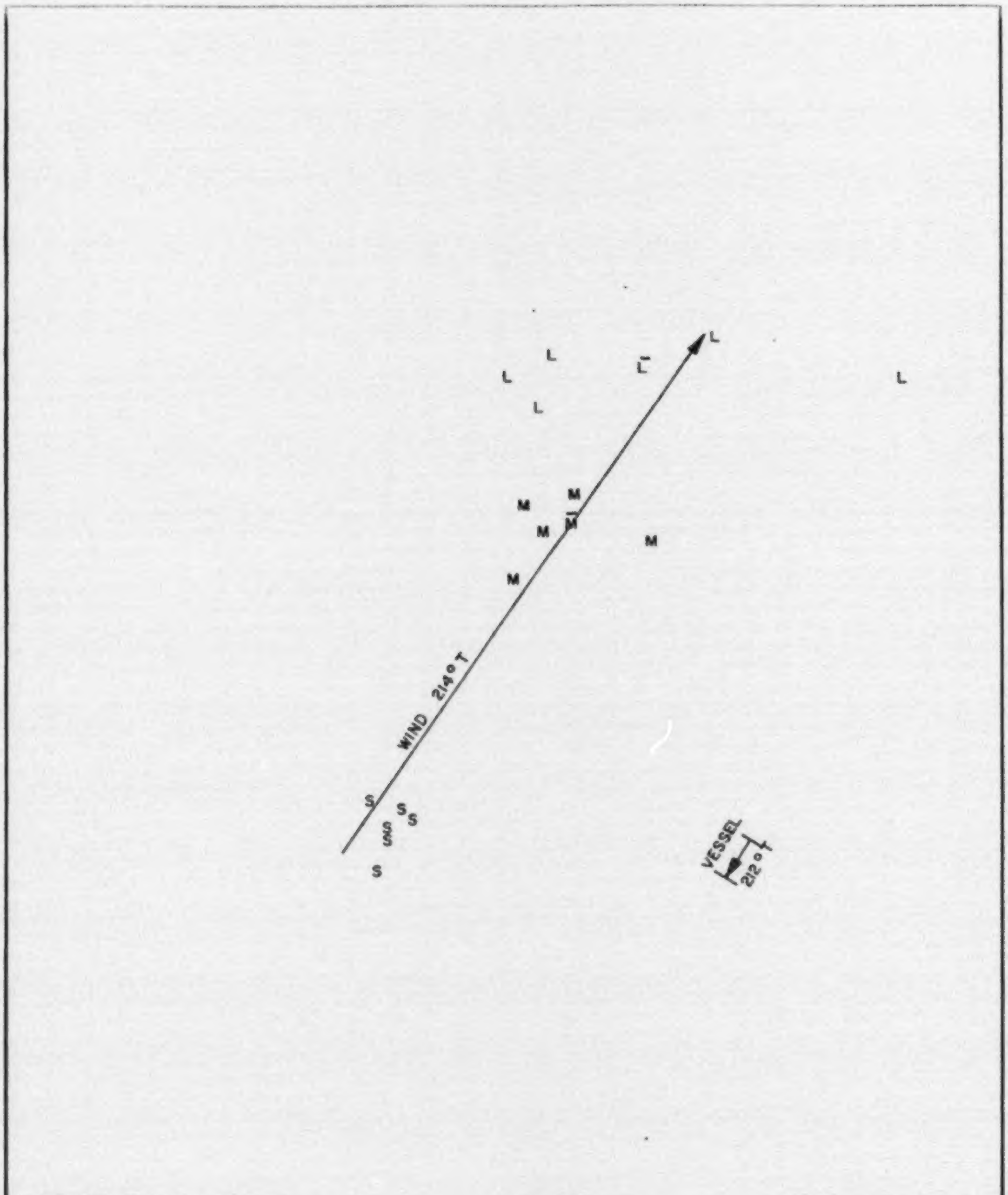


RELATIVE BUOY SPEEDS
S w.r.t.M : 1.09 m/min
L w.r.t.M : 1.04 m/min
MEAN WIND SPEED : 7.4 m/s
SCALE : VESSEL 14.6 m LOA

LEGEND

S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

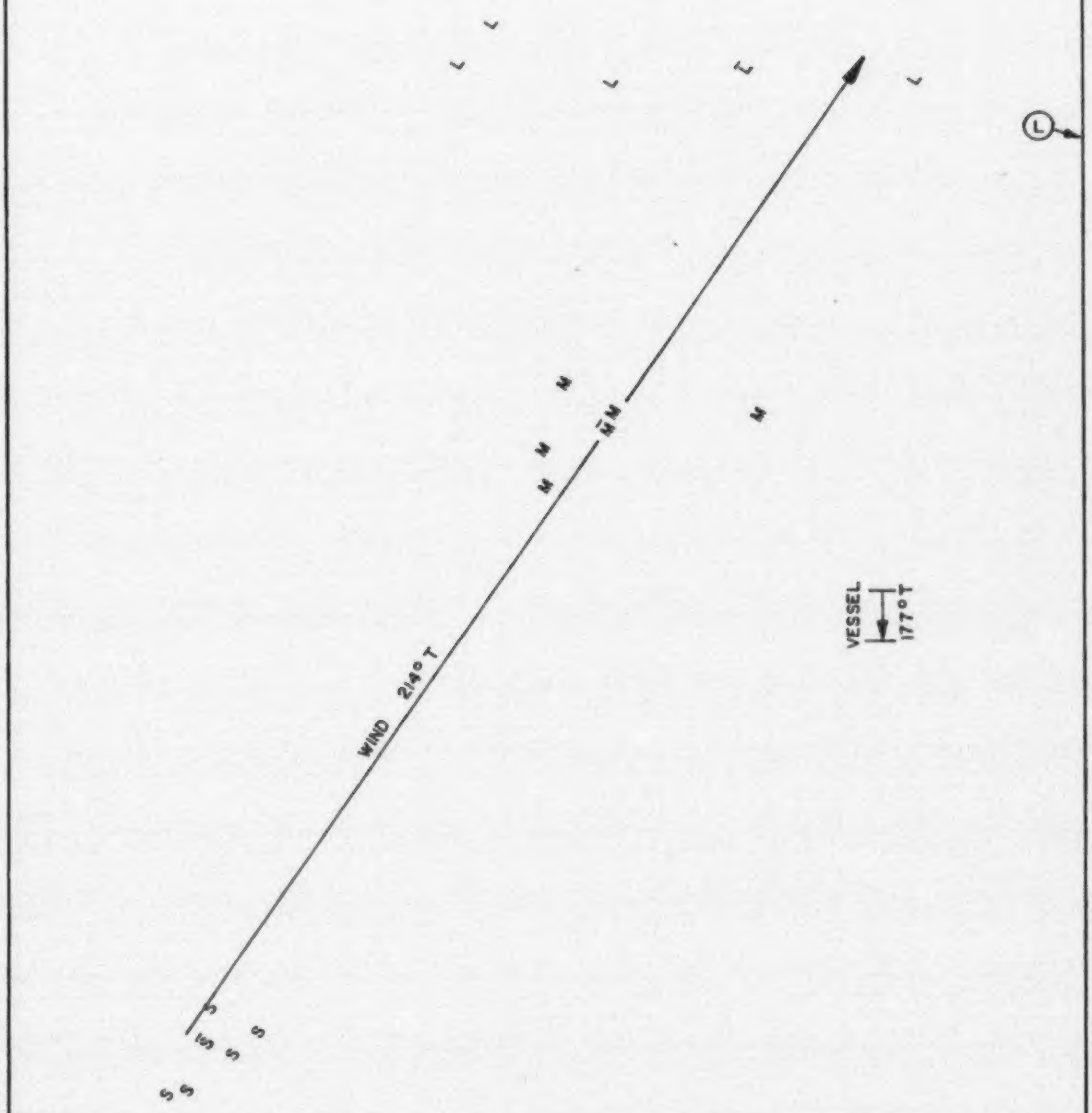
TRIAL : 6
1010-1230
DATE : Nov 9/81 am
TIME : T + 16 min
FIGURE : B-19



RELATIVE BUOY SPEEDS
S wrt M : 3.2 m/min
L wrt M : 1.35 m/min
MEAN WIND SPEED : 7.4 m/s
SCALE : VESSEL 14.6m LOA

LEGEND
S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

TRIAL : 6
1010-1230
DATE : Nov 9/81 am
TIME : T + 50 min
FIGURE : B-20

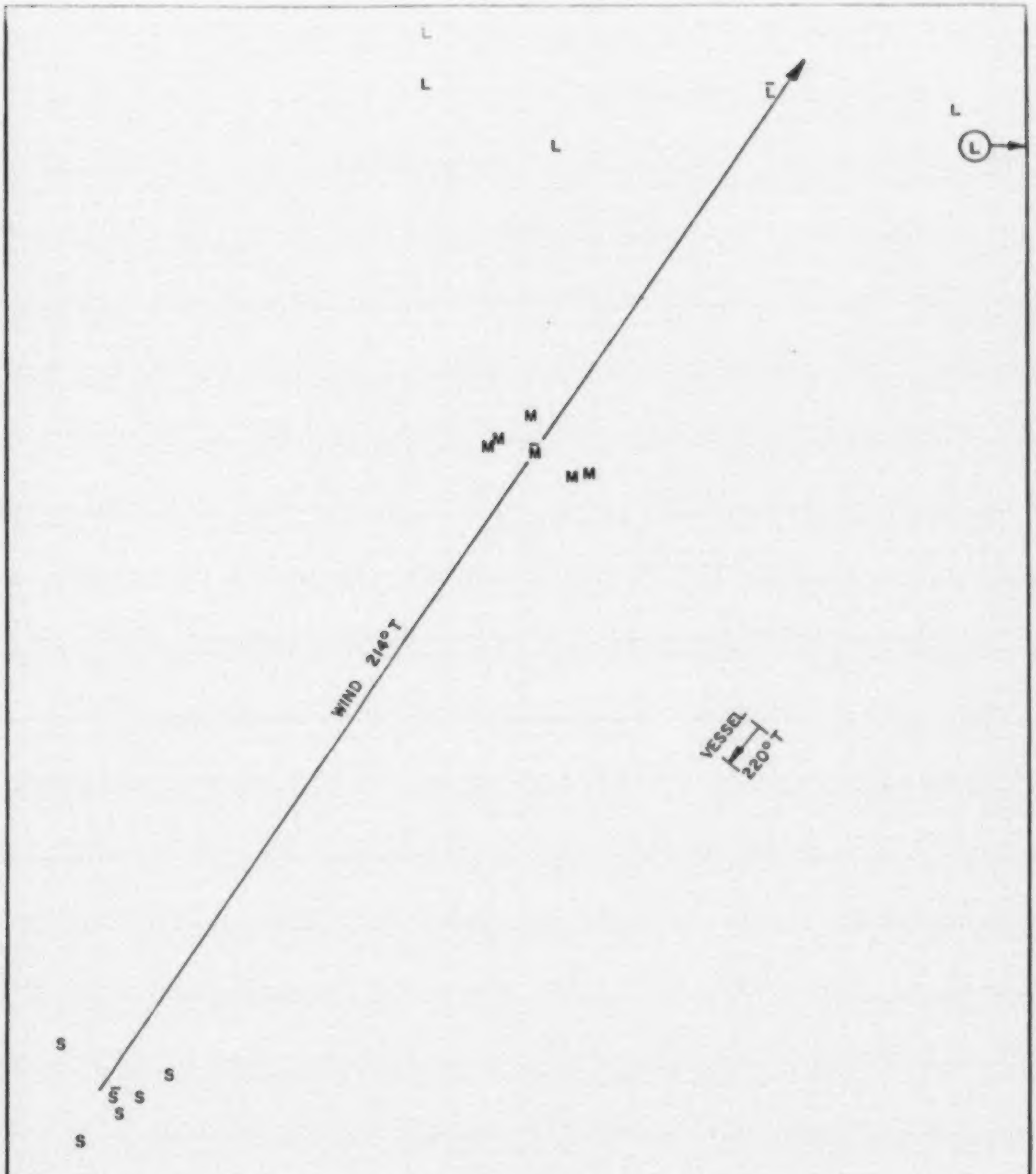


Note: One Large Mast Buoy L, beyond page border. It is included in calculations.

RELATIVE BUOY SPEEDS
S wrt M 3.5 m/min
L wrt M 1.87 m/min
MEAN WIND SPEED 7.4 m/s
SCALE VESSEL 14.6m LOA

LEGEND
S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

TRIAL : 6
1010-1230
DATE : Nov 9/81 am
TIME : T + 83 min
FIGURE B-21



L
L
L̄
L
L
L
L
M
M M
M̄
M M
WIND 214°T
VESSEL
220°T
S
S
S̄ S
S
S

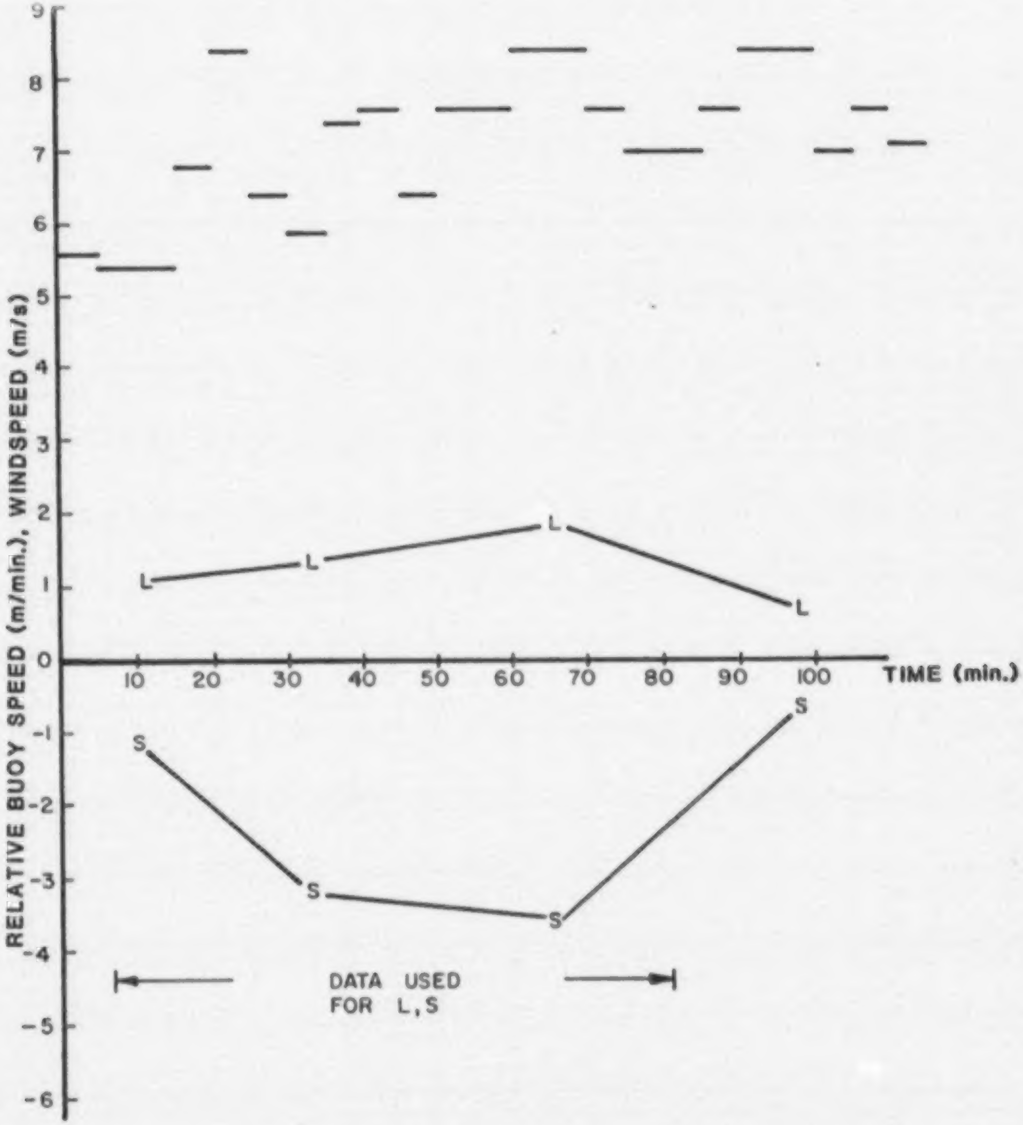
Note: One Large Mast Buoy L beyond page border. It is included in calculations.

RELATIVE BUOY SPEEDS
S w.r.t. M : 0.7 m/min
L w.r.t. M : 0.7 m/min
MEAN WIND SPEED : 7.4 m/s
SCALE : VESSEL 14.6 m LOA

LEGEND

S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

TRIAL : 6
1010-1230
DATE : Nov 9/81 am
TIME : T + 117 min
FIGURE : B-22



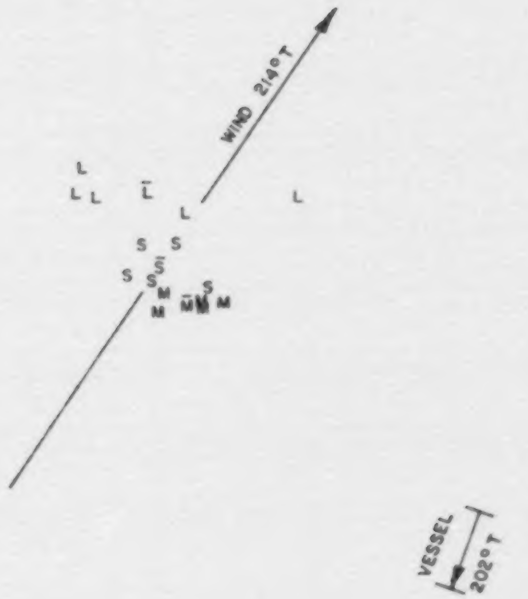
BUOY SPEED (RELATIVE, AT TIME BETWEEN FIXES)

Vs TIME (ELAPSED)

LEGEND

L - BIO LARGE MAST
S - BIO SMALL MAST
— — WIND

TRIAL: 6
DATE: NOV 9/81, 1010-1210
TIDE: HI - 0525, LOW 1145
AV. WIND SPEED: 7.4 m/s
FIGURE: B-23

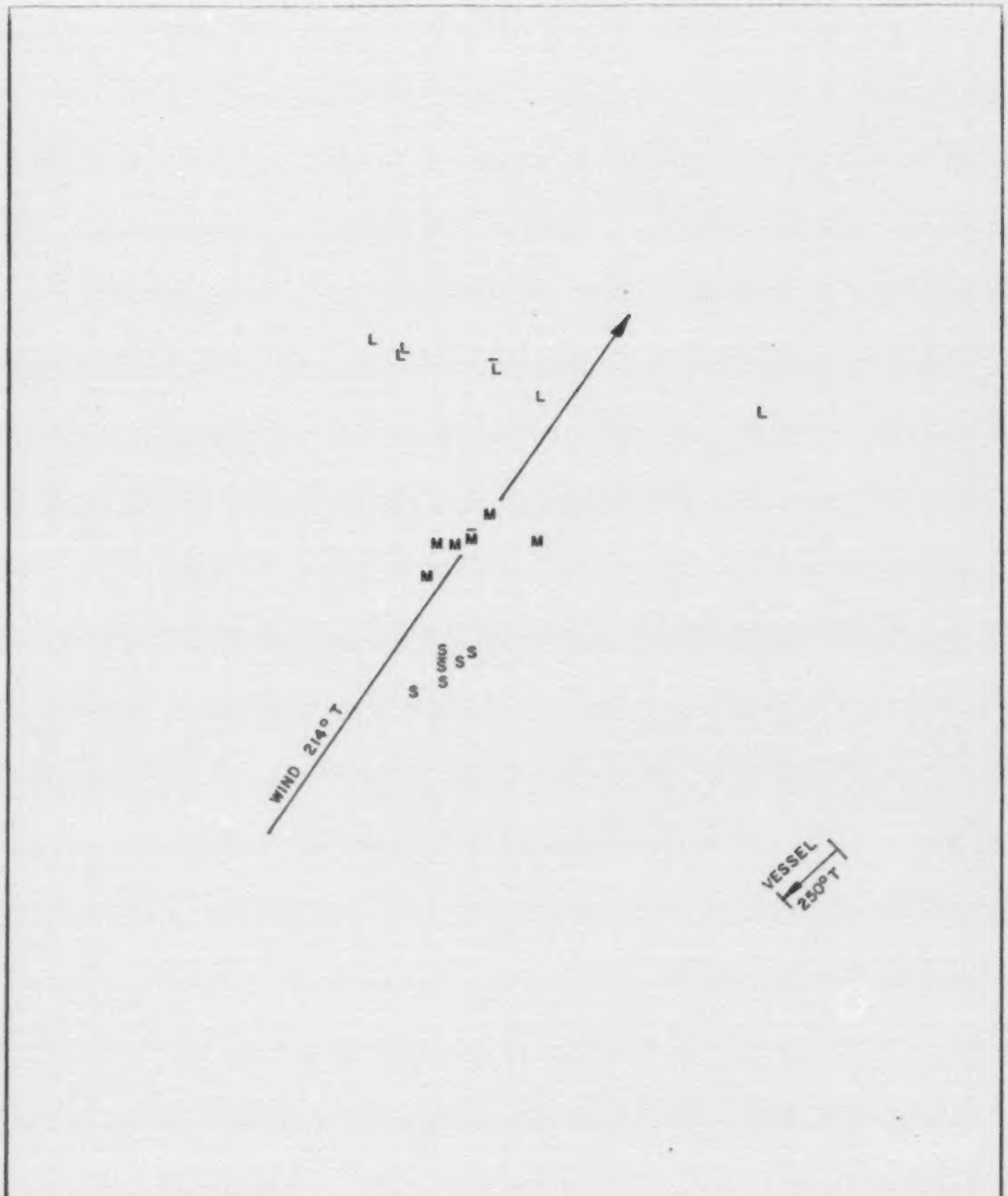

WIND 214°T
L
L L
L
L
L
S S
S
S S
M
M M M M
S
M
VESSEL
202°T

RELATIVE BUOY SPEEDS
S wrt.M : N/A
L wrt.M : N/A
MEAN WIND SPEED : 7.5 m/s
SCALE : VESSEL 14.6m LOA

LEGEND

S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

TRIAL : 7
1335-1513
DATE : Nov 9/81 pm
TIME : T + 9 min
FIGURE : B-24

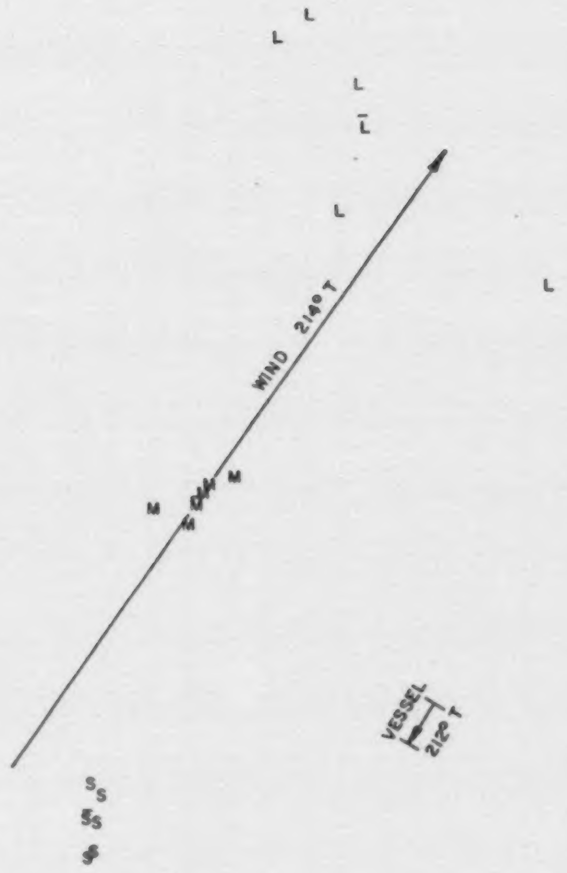


RELATIVE BUOY SPEEDS
S w.r.t.M : 2.3 m/min
L w.r.t.M : 2.5 m/min
MEAN WIND SPEED : 7.5 m/s
SCALE : VESSEL 14.6 m LOA

LEGEND

S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

TRIAL : 7
1335-1513
DATE : Nov 9/81 pm
TIME : T + 18 min
FIGURE : B-25

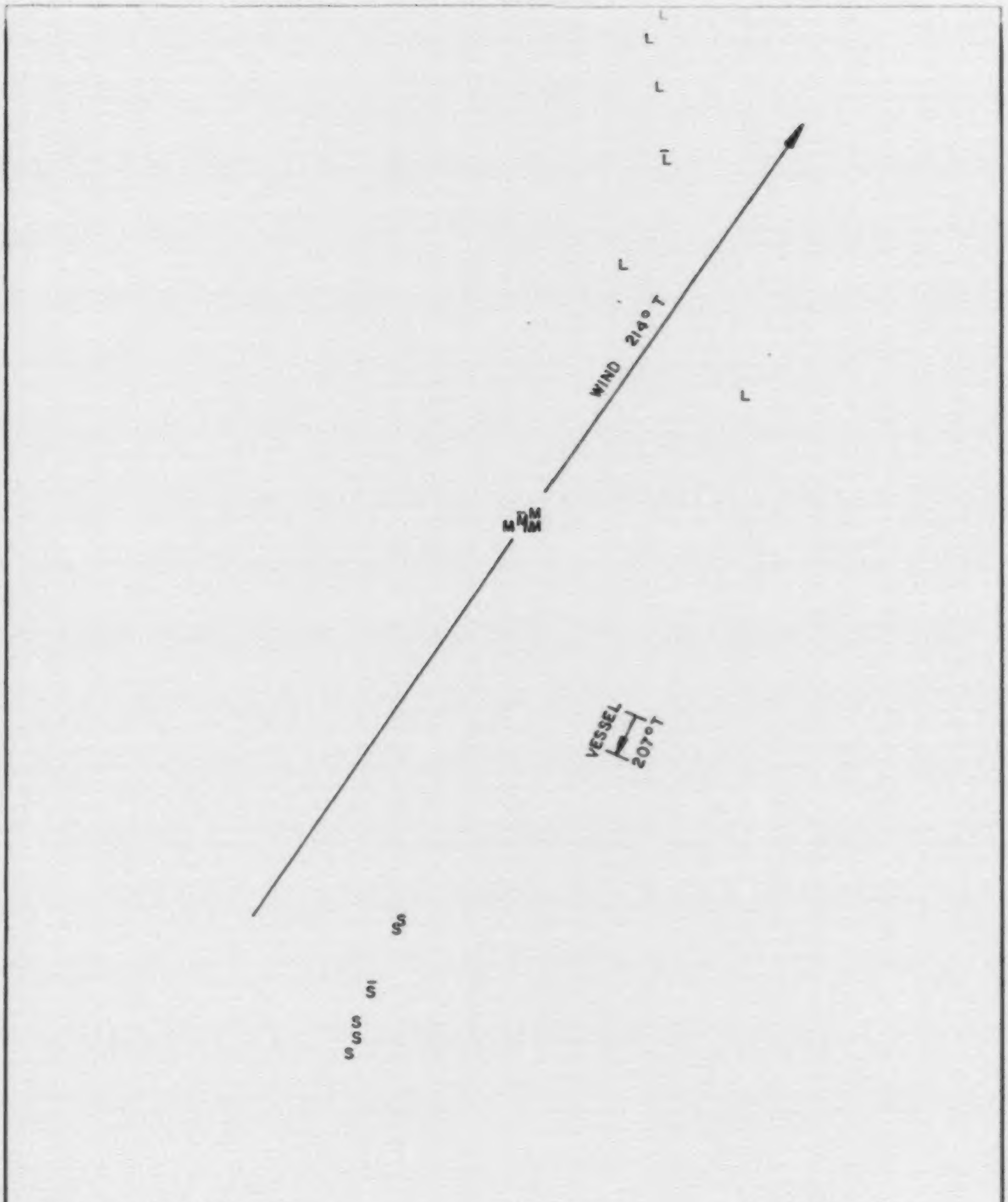


RELATIVE BUOY SPEEDS
S w.r.t.M : 2.5 m/min
L w.r.t.M : 3.06 m/min
MEAN WIND SPEED : 7.5 m/s
SCALE : VESSEL 14.6m LOA

LEGEND

S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

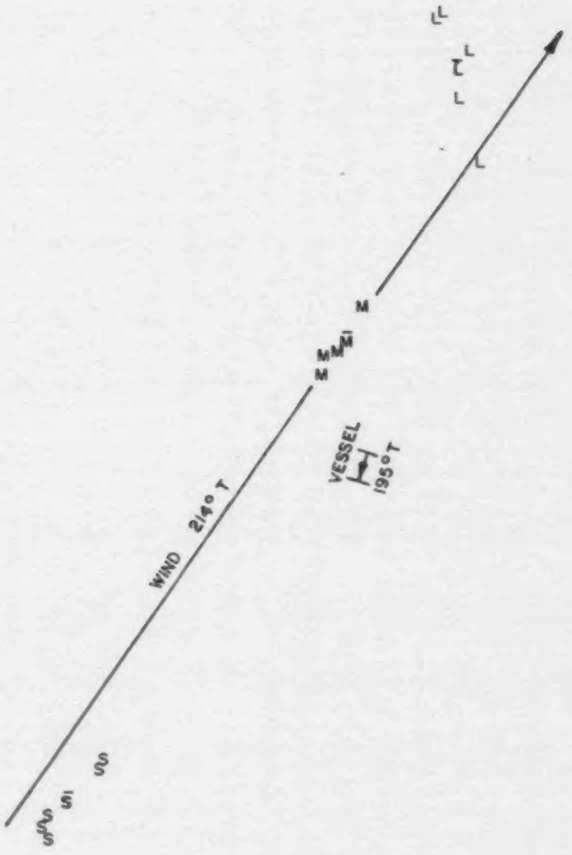
TRIAL : 7
1335-1513
DATE : Nov 9/81 pm
TIME : T + 50 min
FIGURE : B-26



RELATIVE BUOY SPEEDS
S w.r.t.M : 2.37 m/min
L w.r.t.M : 0.13 m/min
MEAN WIND SPEED : 7.5 m/s
SCALE : VESSEL 14.6 m LOA

LEGEND
S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

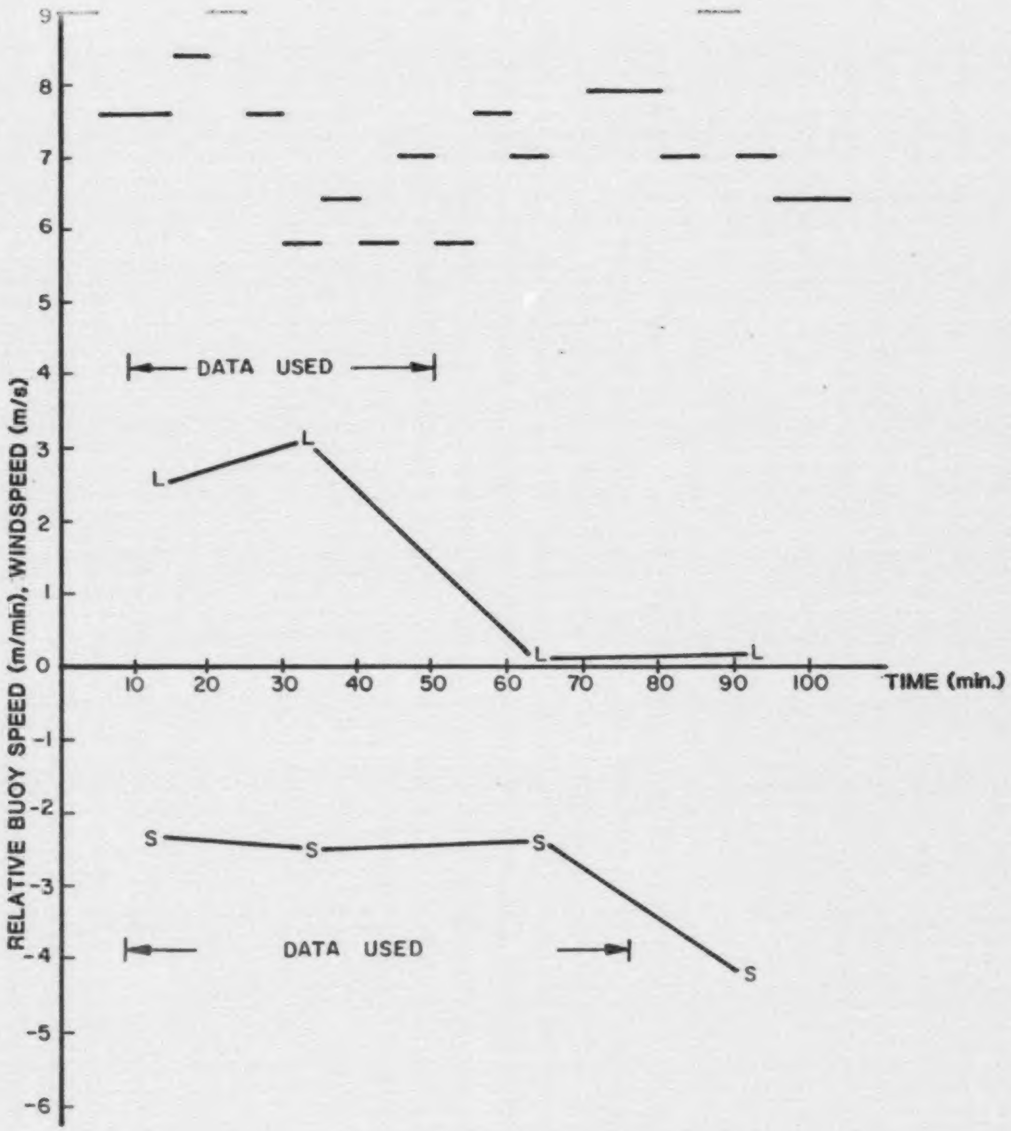
TRIAL : 7
1335-1513
DATE : Nov 9/81 pm
TIME : T + 77 min
FIGURE : B-27


L
L
L
L
L
L
M
M
M
M
M
WIND 214° T
VESSEL
195° T
S
S
S
S
S
S

RELATIVE BUOY SPEEDS
S w.r.t.M : 4.23 m/min
L w.r.t.M : 0.17 m/min
MEAN WIND SPEED : 7.5 m/min
SCALE : VESSEL 14.6 m LOA

LEGEND
S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

TRIAL : 7
1335-1513
DATE : Nov 9/81 pm
TIME : T + 108 min
FIGURE : B-28



BUOY SPEED (RELATIVE, AT TIME BETWEEN FIXES)

Vs TIME (ELAPSED)

LEGEND

L - BIO LARGE MAST
S - BIO SMALL MAST
— — WIND

TRIAL 7
DATE NOV 9/81, 1335 - 1513
TIDE LOW 1145, HI 1735
AV. WIND SPEED 7.5 m/s
FIGURE: B-29

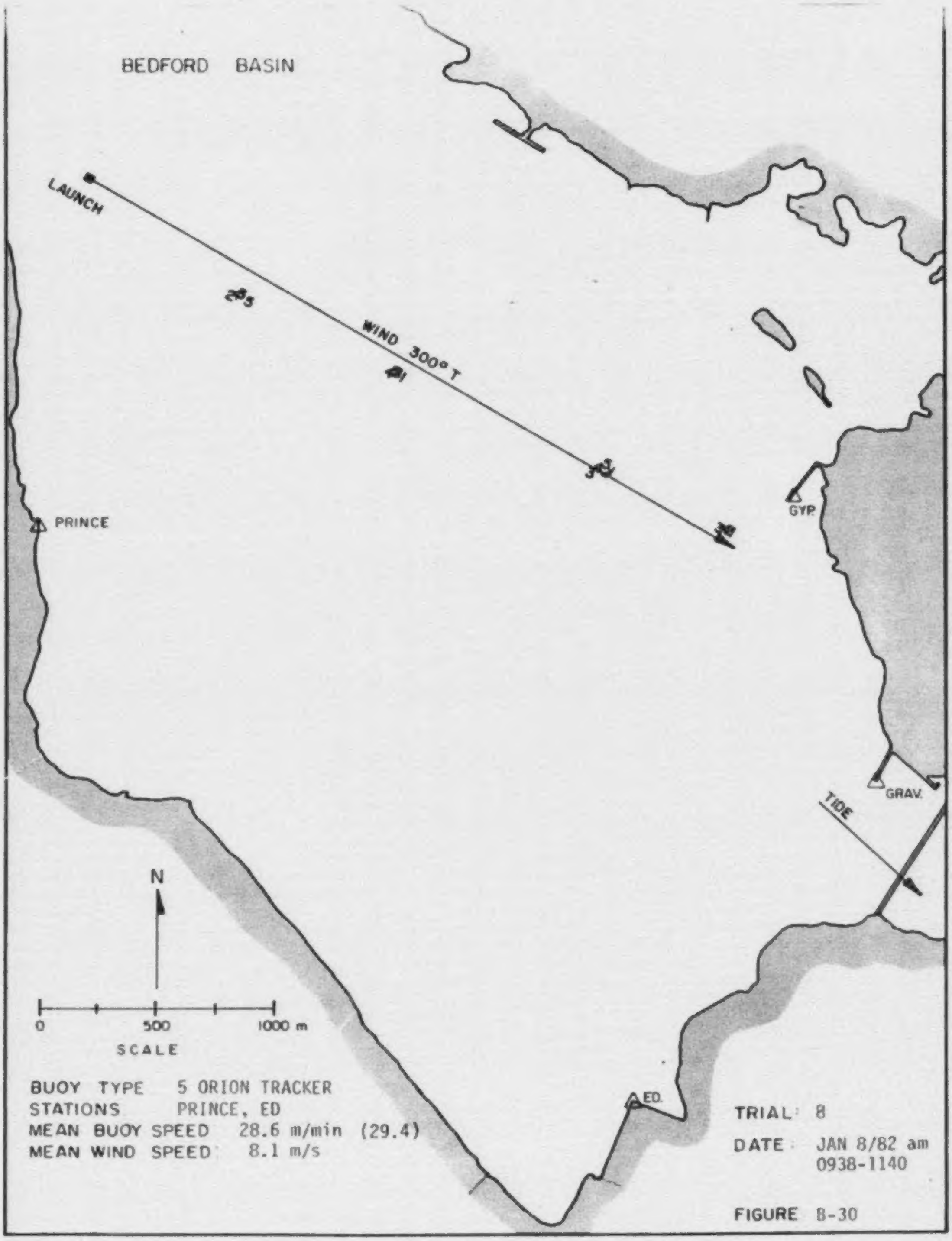
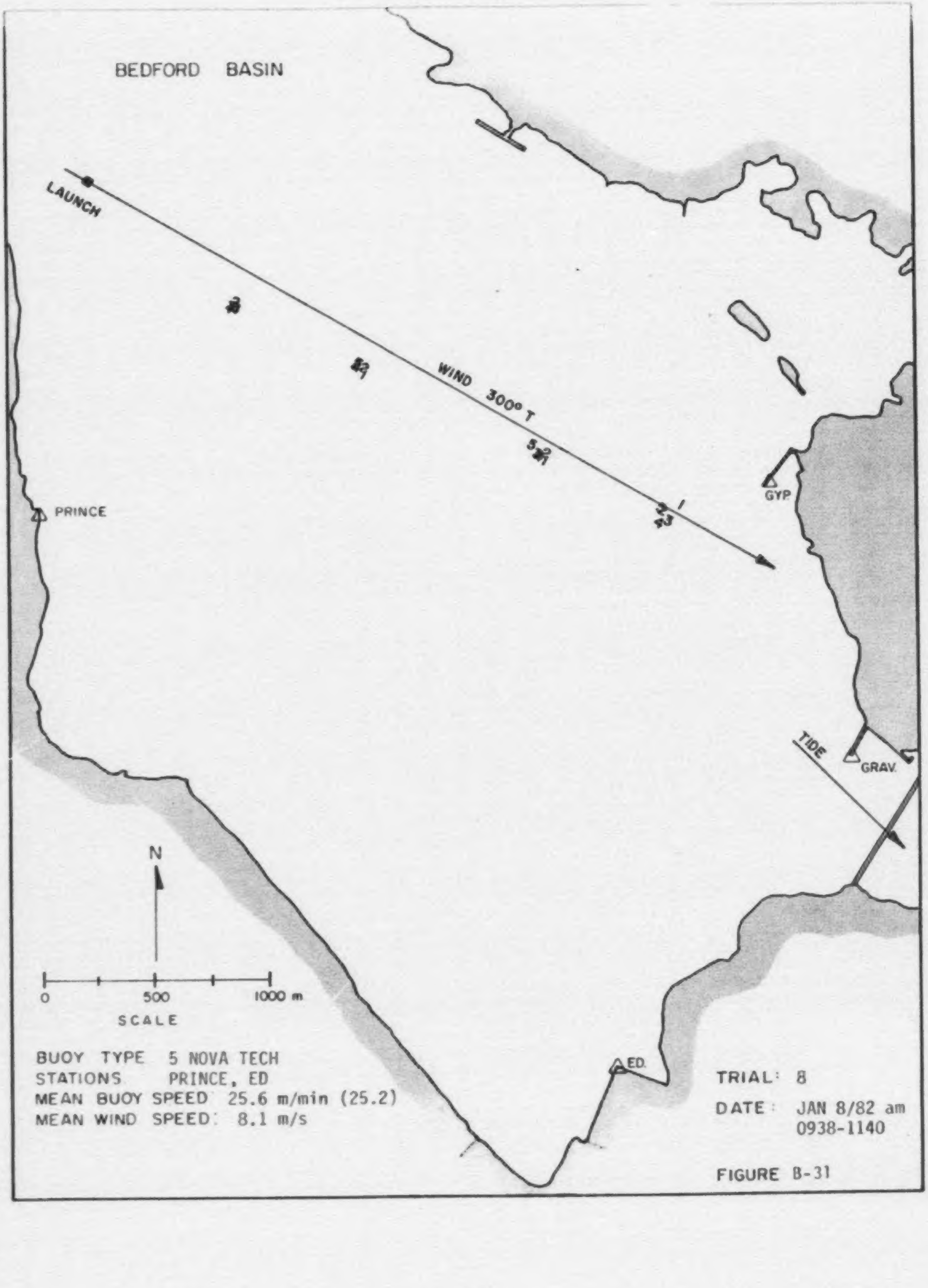

BEDFORD BASIN
LAUNCH
WIND 300° T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE
BUOY TYPE 5 ORION TRACKER
STATIONS PRINCE, ED
MEAN BUOY SPEED 28.6 m/min (29.4)
MEAN WIND SPEED 8.1 m/s
TRIAL: 8
DATE: JAN 8/82 am
0938-1140

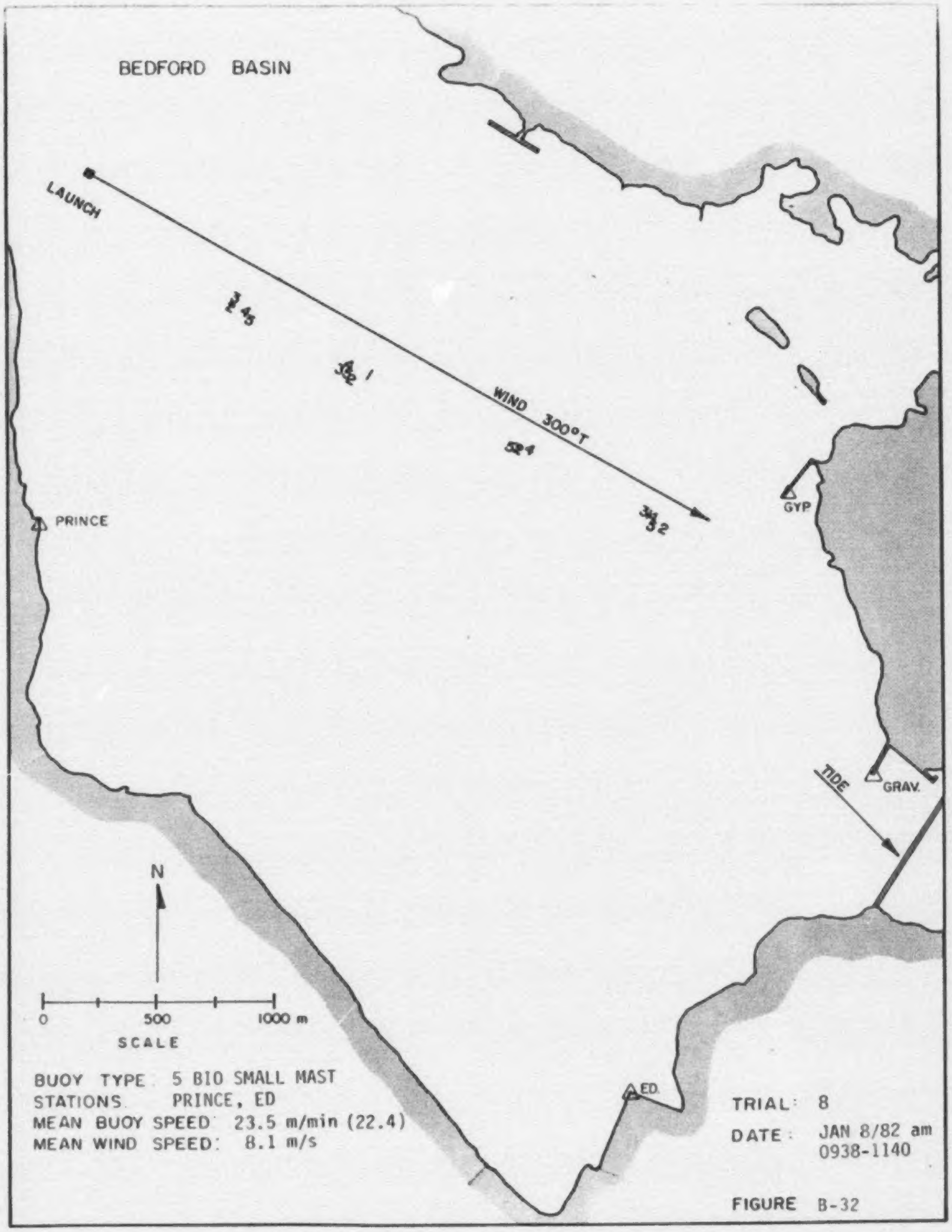
FIGURE B-30


BEDFORD BASIN
LAUNCH
WIND 300° T
PRINCE
GYP
TIDE
GRAV.
ED.
N
0
500
1000 m
SCALE

BUOY TYPE 5 NOVA TECH
STATIONS PRINCE, ED
MEAN BUOY SPEED 25.6 m/min (25.2)
MEAN WIND SPEED: 8.1 m/s

TRIAL: 8
DATE: JAN 8/82 am
0938-1140

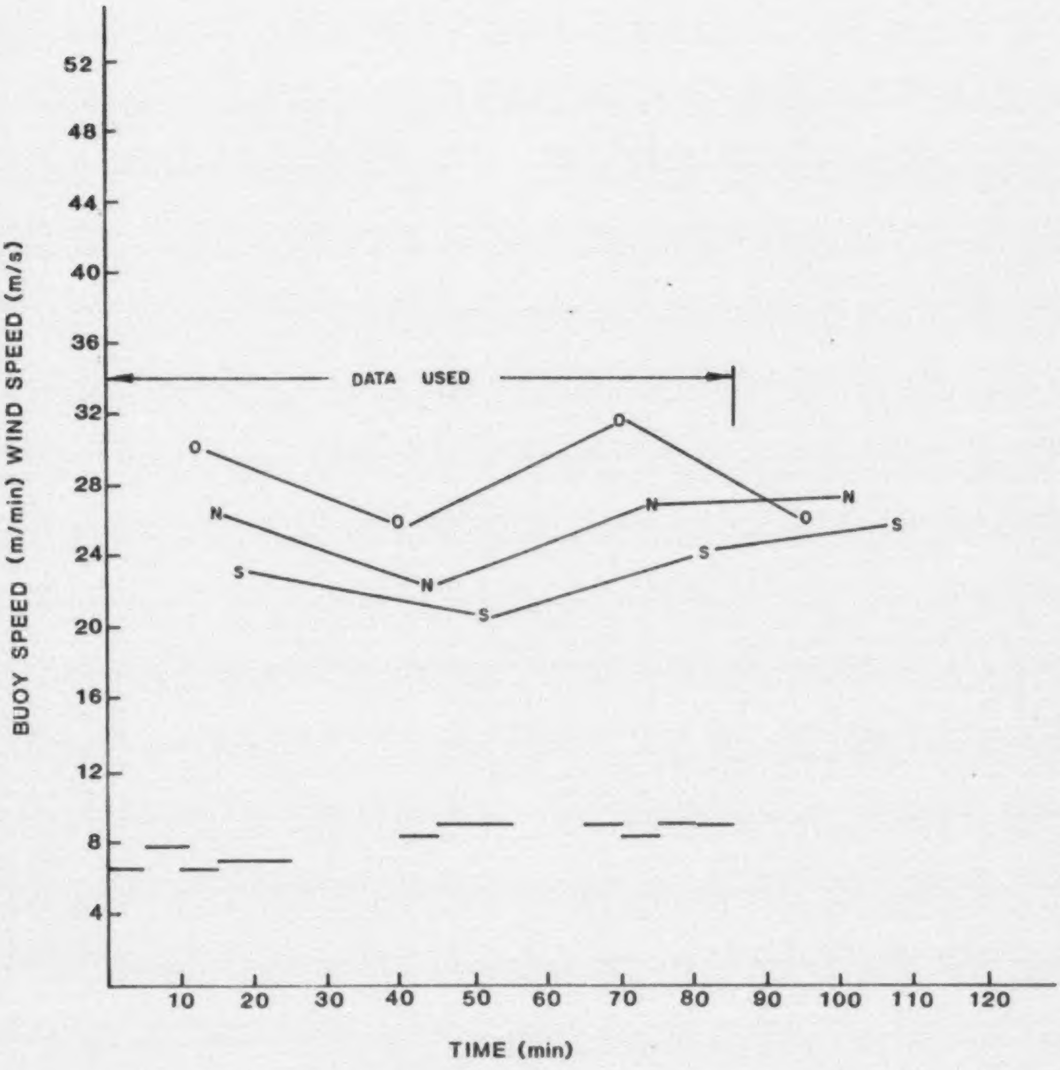
FIGURE B-31


BEDFORD BASIN
LAUNCH
WIND 300°T
PRINCE
GYP
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO SMALL MAST
STATIONS: PRINCE, ED
MEAN BUOY SPEED: 23.5 m/min (22.4)
MEAN WIND SPEED: 8.1 m/s

TRIAL: 8
DATE: JAN 8/82 am
0938-1140

FIGURE B-32

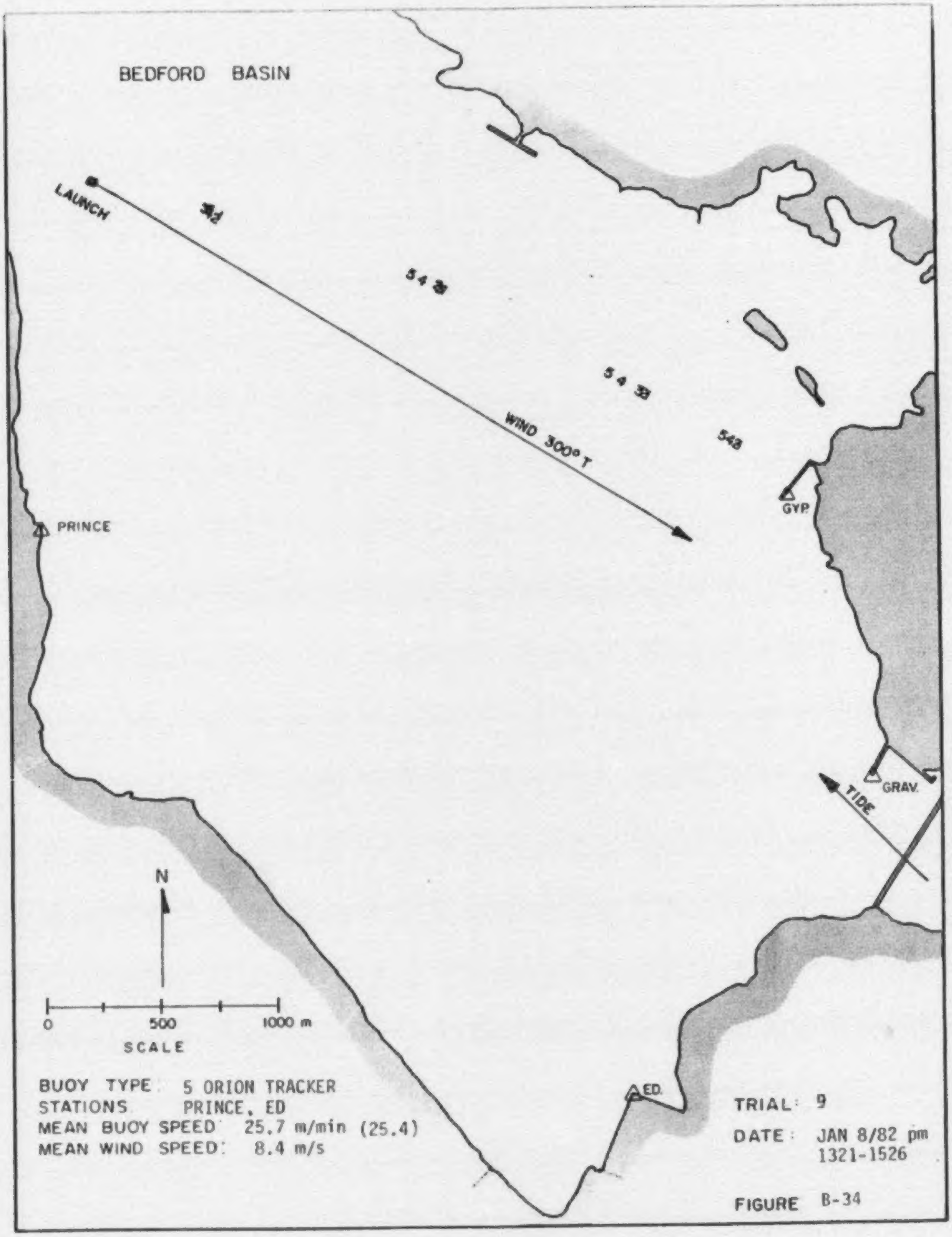


BUOY SPEED (ABSOLUTE, AT
TIME BETWEEN FIXES) Vs TIME (ELAPSED)

LEGEND

O - ORION TRACKER
N - NOVA TECH
S - BIO SMALL MAST
— — WIND

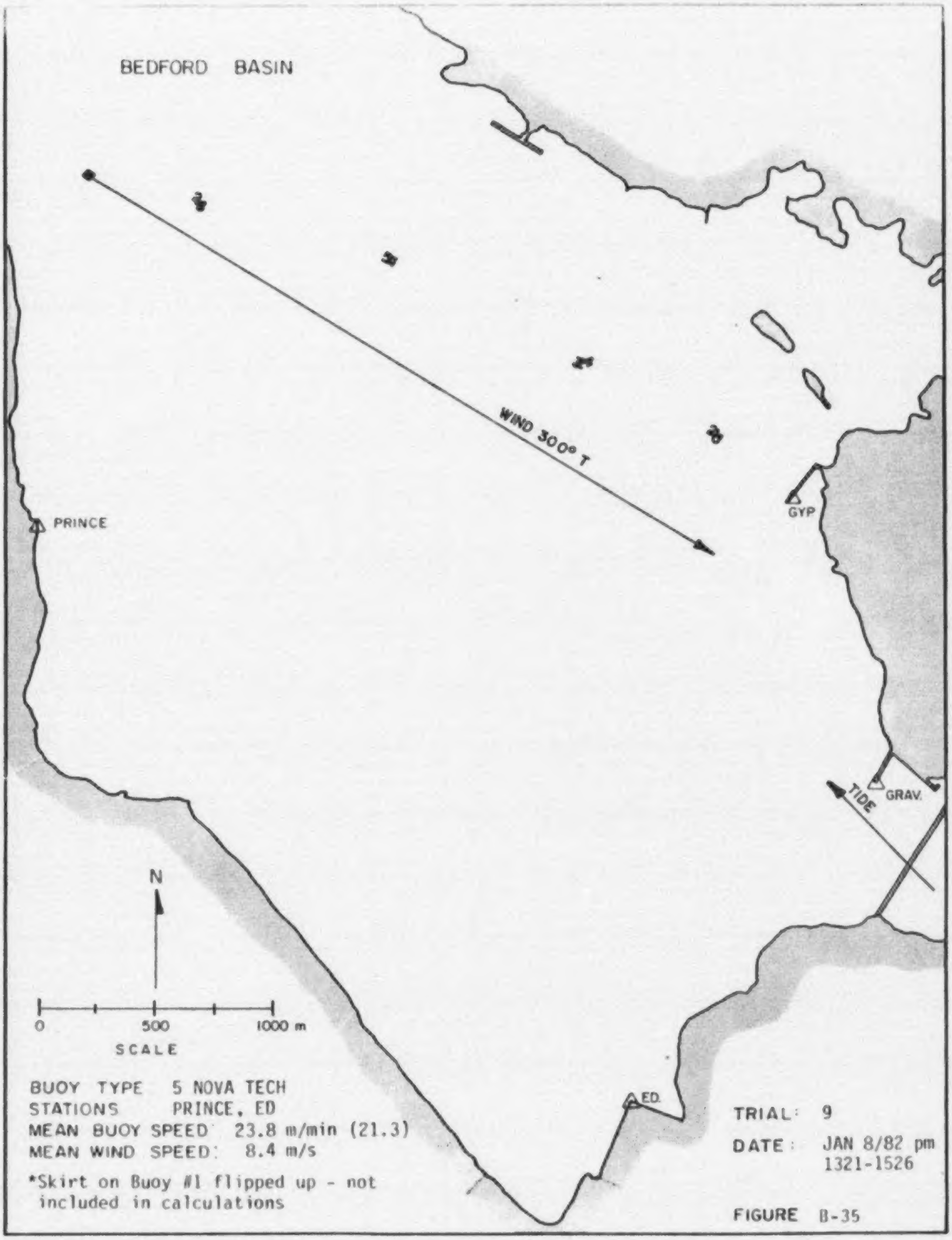
TRIAL : 8
DATE : JAN 8/82, 0938-1140
TIDE : HI - 0605
LOW - 1315
AV. WIND SPEED : 8.1 m/s
FIGURE : B-33


BEDFORD BASIN
LAUNCH
5 4 3 2
5 4 3 2
5 4 3
WIND 300° T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 ORION TRACKER
STATIONS: PRINCE, ED
MEAN BUOY SPEED: 25.7 m/min (25.4)
MEAN WIND SPEED: 8.4 m/s

TRIAL: 9
DATE: JAN 8/82 pm
1321-1526

FIGURE B-34


BEDFORD BASIN
WIND 300° T
PRINCE
GYP
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

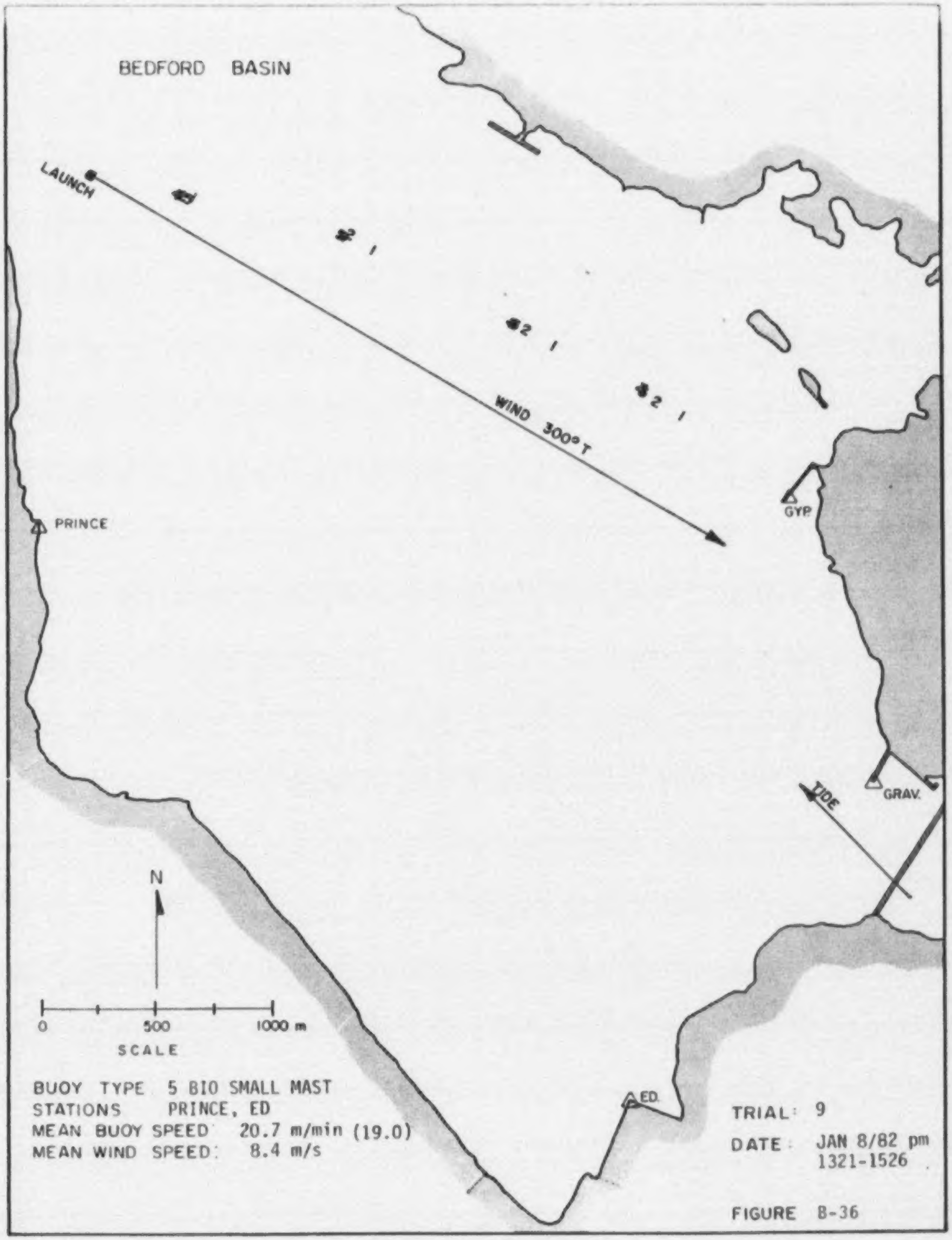
BUOY TYPE 5 NOVA TECH
STATIONS PRINCE, ED
MEAN BUOY SPEED 23.8 m/min (21.3)
MEAN WIND SPEED: 8.4 m/s

*Skirt on Buoy #1 flipped up - not included in calculations

TRIAL: 9

DATE: JAN 8/82 pm
1321-1526

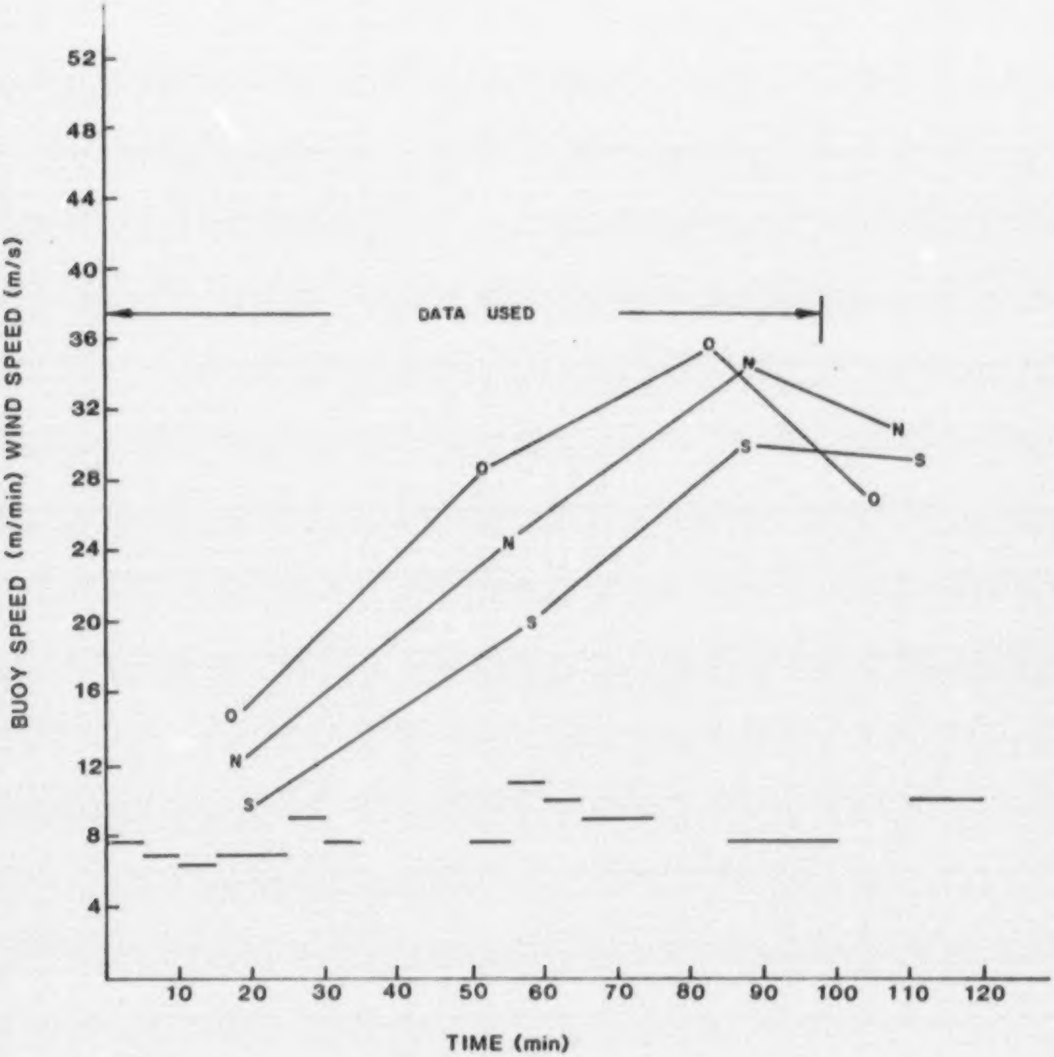
FIGURE B-35


BEDFORD BASIN
LAUNCH
WIND 300°T
2 1
2 1
2 1
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE 5 BIO SMALL MAST
STATIONS PRINCE, ED
MEAN BUOY SPEED: 20.7 m/min (19.0)
MEAN WIND SPEED: 8.4 m/s

TRIAL: 9
DATE: JAN 8/82 pm
1321-1526

FIGURE B-36



BUOY SPEED (ABSOLUTE, AT
TIME BETWEEN FIXES) Vs TIME (ELAPSED)

LEGEND

O - ORION TRACKER
N - NOVA TECH
S - BIO SMALL MAST
— — WIND

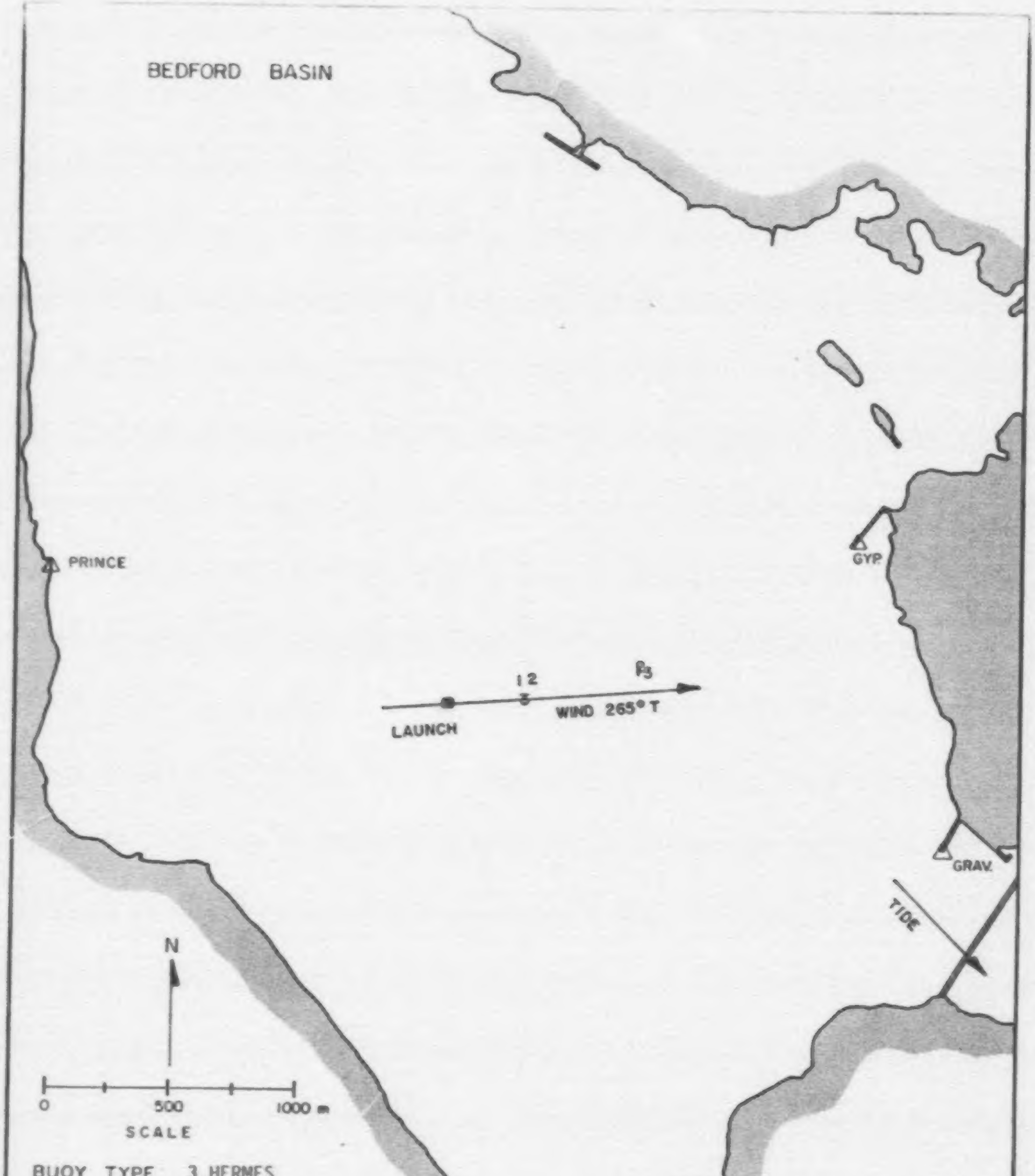
TRIAL : 9

DATE : JAN 8/82, 1321-1526

TIDE : LOW - 1315
HI - 1855

AV. WIND SPEED : 8.2 m/s

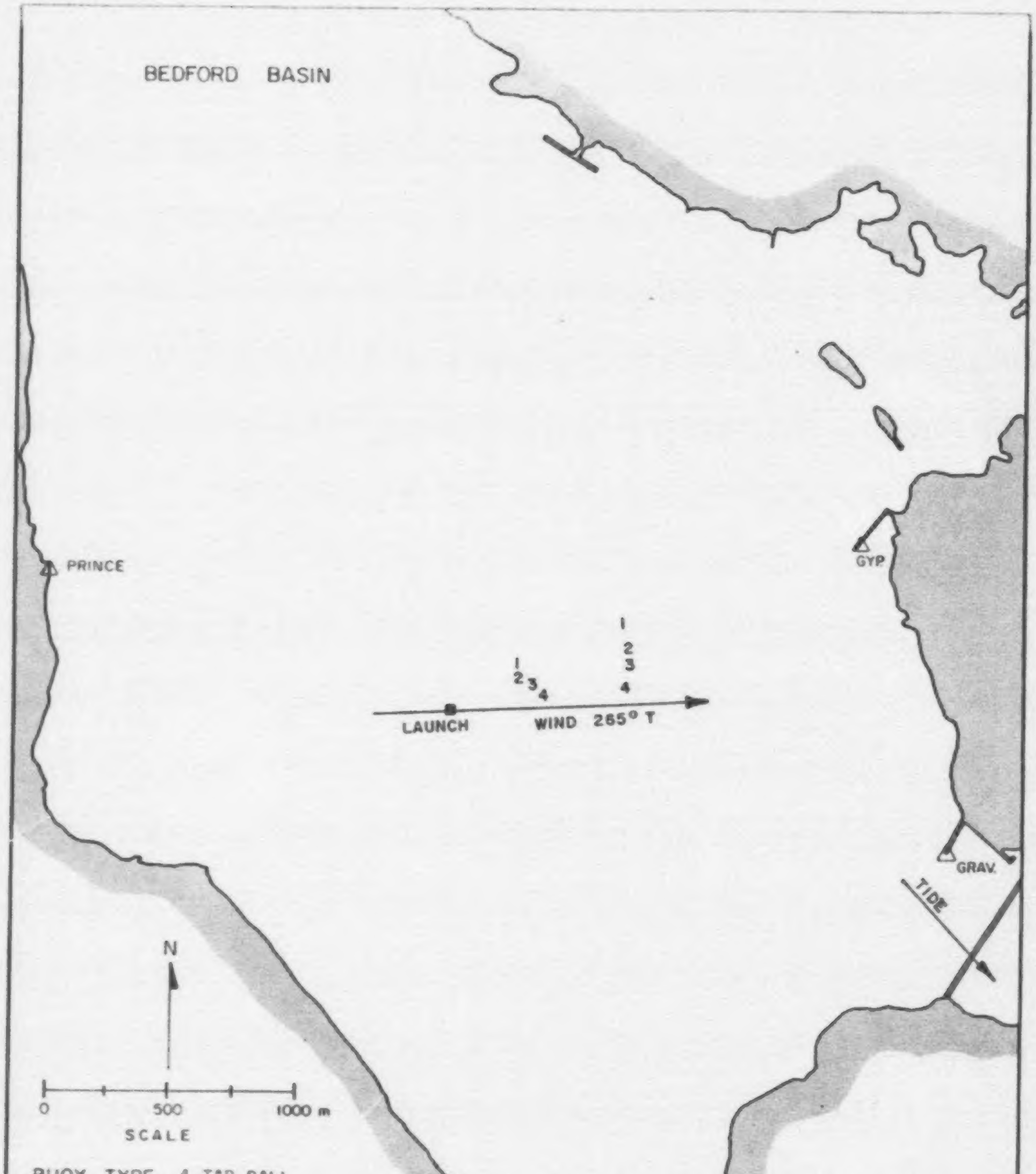
FIGURE : B-37


BEDFORD BASIN
PRINCE
GYP.
1 2
B3
LAUNCH
WIND 265° T
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 3 HERMES
STATIONS: PRINCE, ED
MEAN BUOY SPEED: 10.0 m/min
MEAN WIND SPEED: 5.6 m/s

TRIAL: 11
DATE: JAN 13/82 pm
1415-1540

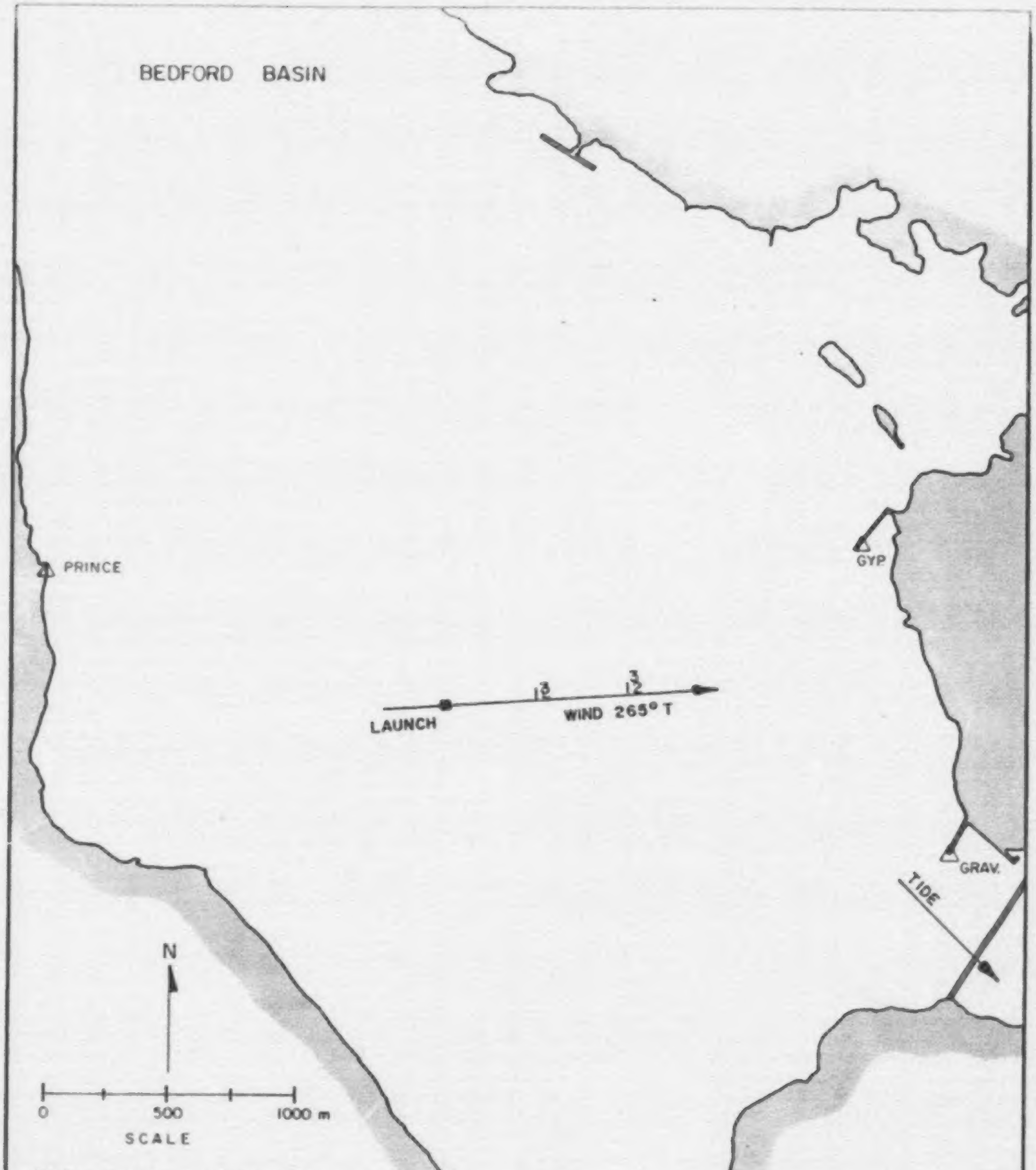
FIGURE B-38


BEDFORD BASIN
PRINCE
GYP.
GRAV.
ED.
TIDE
LAUNCH
WIND 265° T
1
2
3
4
N
0
500
1000 m
SCALE

BUOY TYPE 4 TAR BALL
STATIONS PRINCE, ED
MEAN BUOY SPEED 9.6 m/min
MEAN WIND SPEED 5.6 m/s

TRIAL: 11
DATE: JAN 13/82 pm
1415-1540

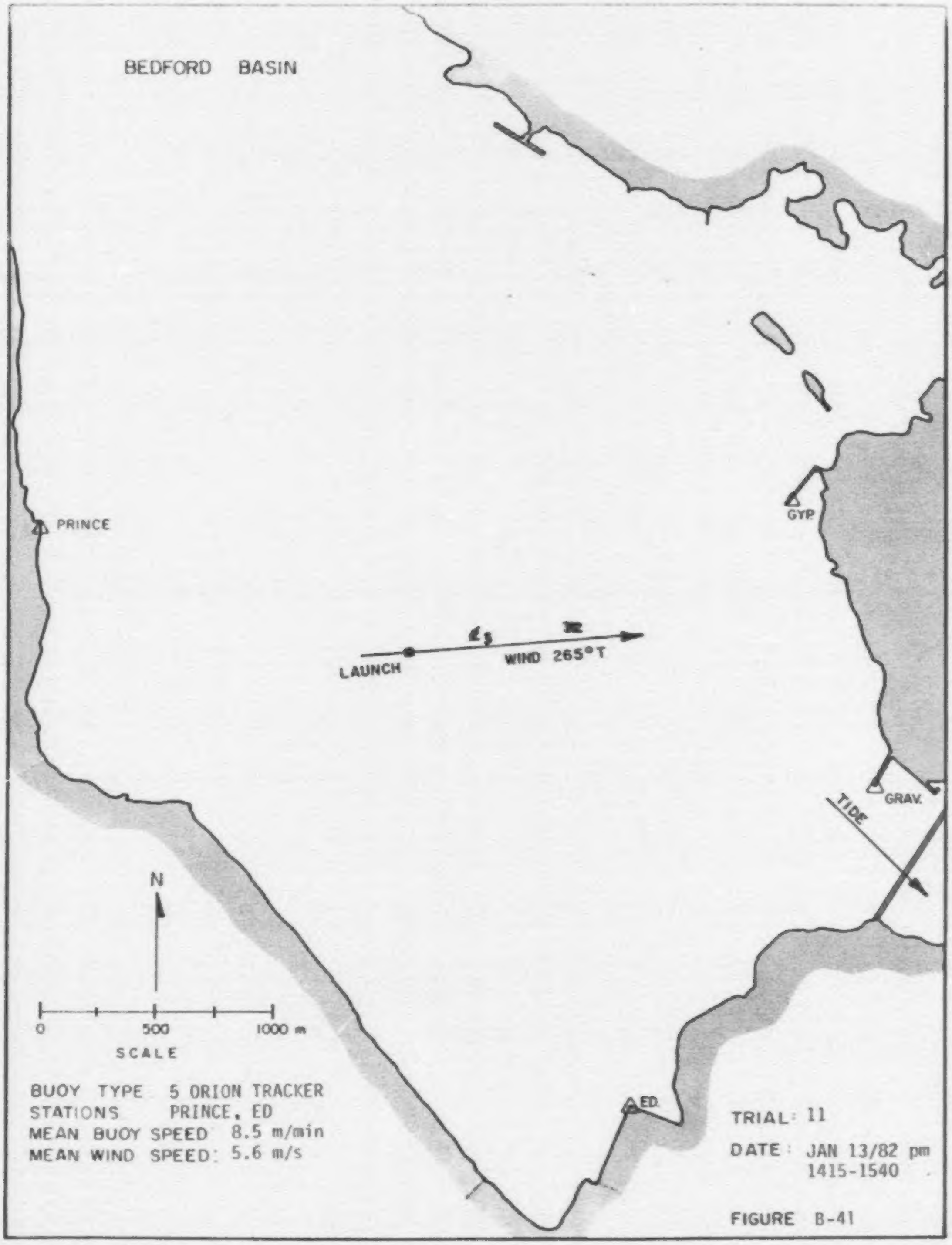
FIGURE B-39


BEDFORD BASIN
PRINCE
GYP
LAUNCH
3
12
3
12
WIND 265° T
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE 3 ORION 4800
STATIONS PRINCE, ED
MEAN BUOY SPEED 9.8 m/min
MEAN WIND SPEED: 5.6 m/s

TRIAL: 11
DATE: JAN 13/82 pm
1415-1540

FIGURE B-40


BEDFORD BASIN
PRINCE
GYP.
GRAV.
TIDE
ED.
LAUNCH
WIND 265°T
N
0
500
1000 m
SCALE

BUOY TYPE 5 ORION TRACKER
STATIONS PRINCE, ED
MEAN BUOY SPEED 8.5 m/min
MEAN WIND SPEED: 5.6 m/s

TRIAL: 11

DATE: JAN 13/82 pm
1415-1540

FIGURE B-41

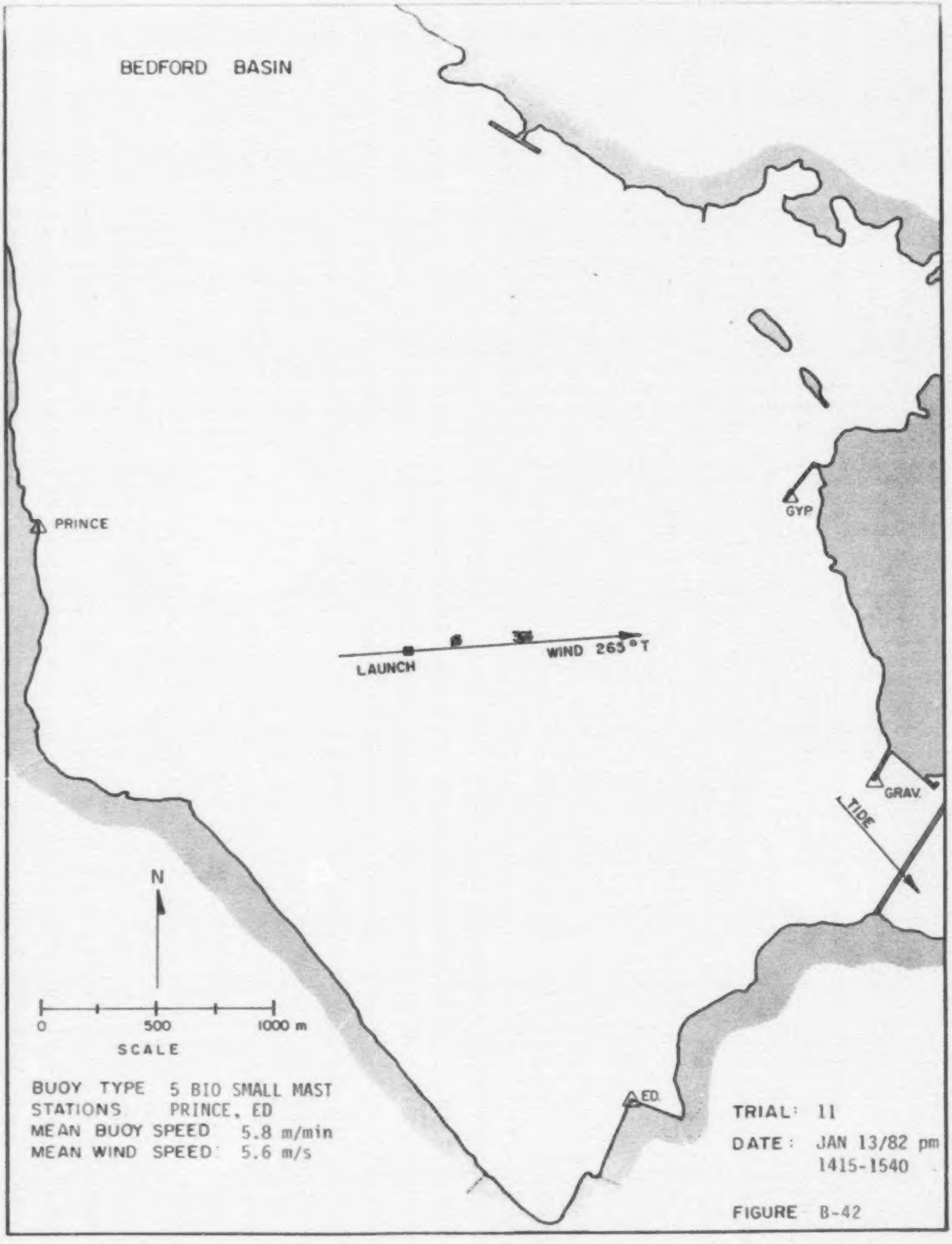
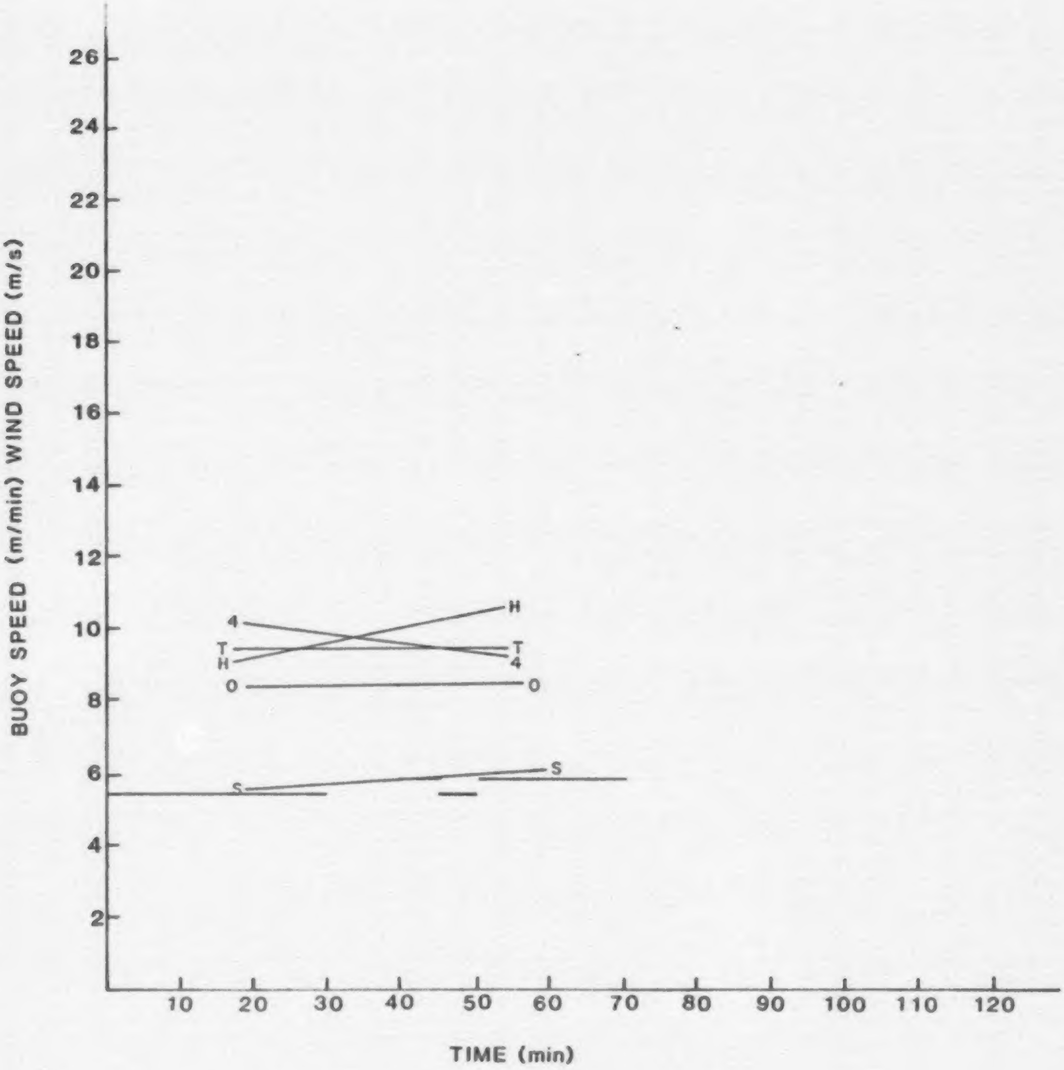

BEDFORD BASIN
PRINCE
GYP.
LAUNCH
WIND 265°T
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.
BUOY TYPE 5 BIO SMALL MAST
STATIONS PRINCE, ED
MEAN BUOY SPEED 5.8 m/min
MEAN WIND SPEED 5.6 m/s
TRIAL: 11
DATE: JAN 13/82 pm
1415-1540

FIGURE B-42



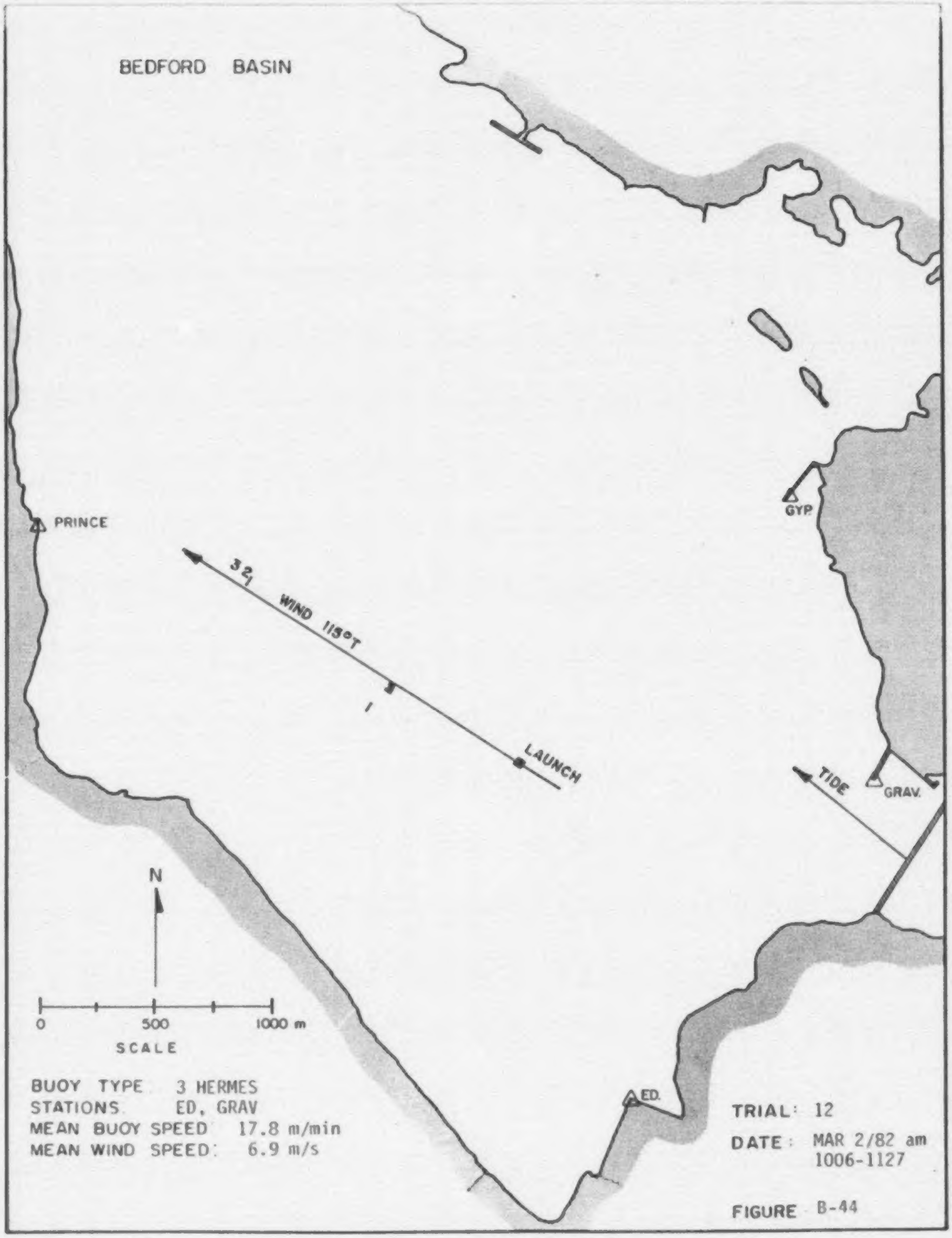
BUOY SPEED (ABSOLUTE, AT
TIME BETWEEN FIXES) Vs TIME (ELAPSED)

LEGEND

H - HERMES
T - TAR BALL
4 - ORION 4800
O - ORION TRACKER
S - BIO SMALL MAST
— — WIND

TRIAL : 11
DATE : JAN 13/82, 1415-1540
TIDE : HI - 1025
LOW - 1725

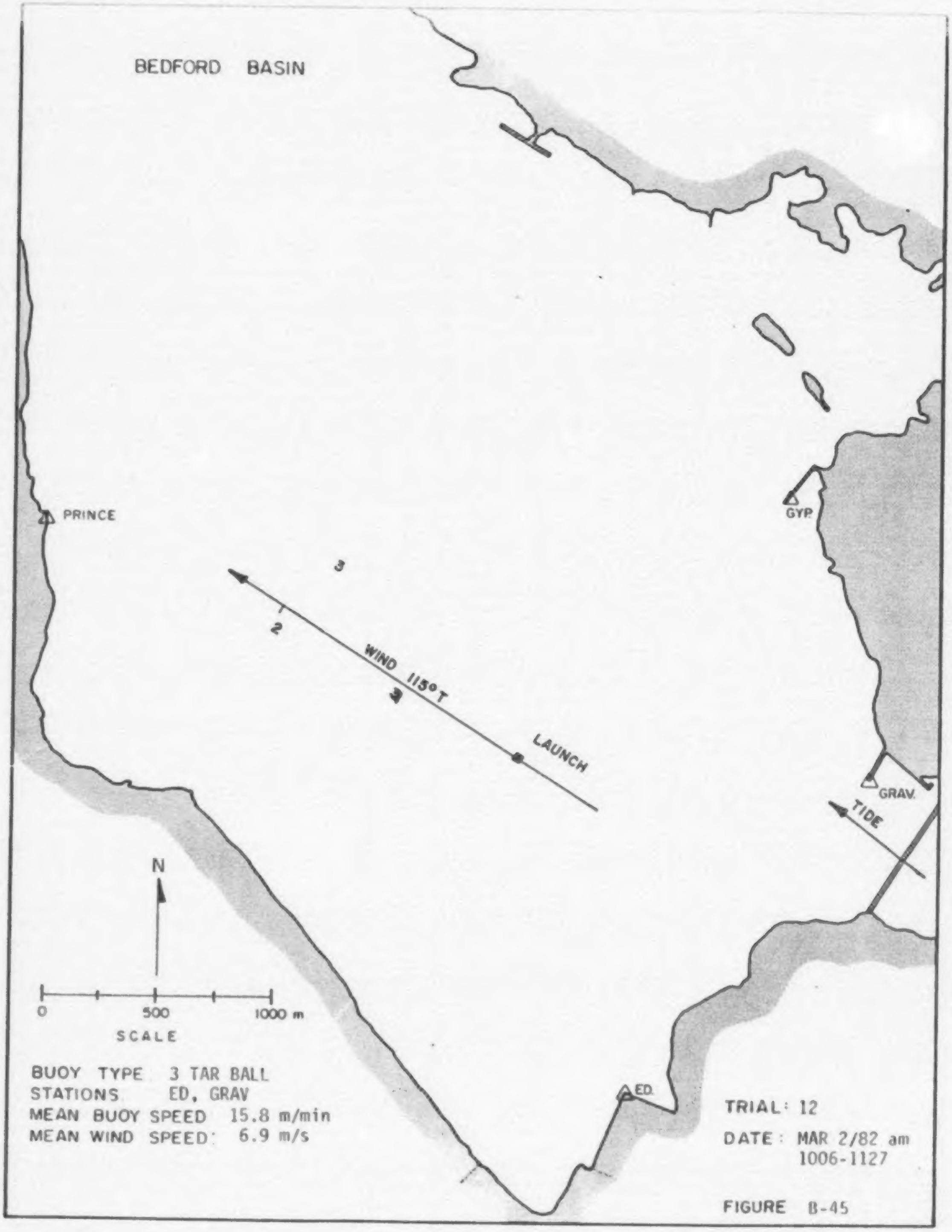
AV. WIND SPEED : 5.6 m/s
FIGURE : B-43


BEDFORD BASIN
PRINCE
GYP.
GRAV.
ED.
32
1
WIND 115°T
LAUNCH
TIDE
N
0
500
1000 m
SCALE

BUOY TYPE: 3 HERMES
STATIONS: ED, GRAV
MEAN BUOY SPEED: 17.8 m/min
MEAN WIND SPEED: 6.9 m/s

TRIAL: 12
DATE: MAR 2/82 am
1006-1127

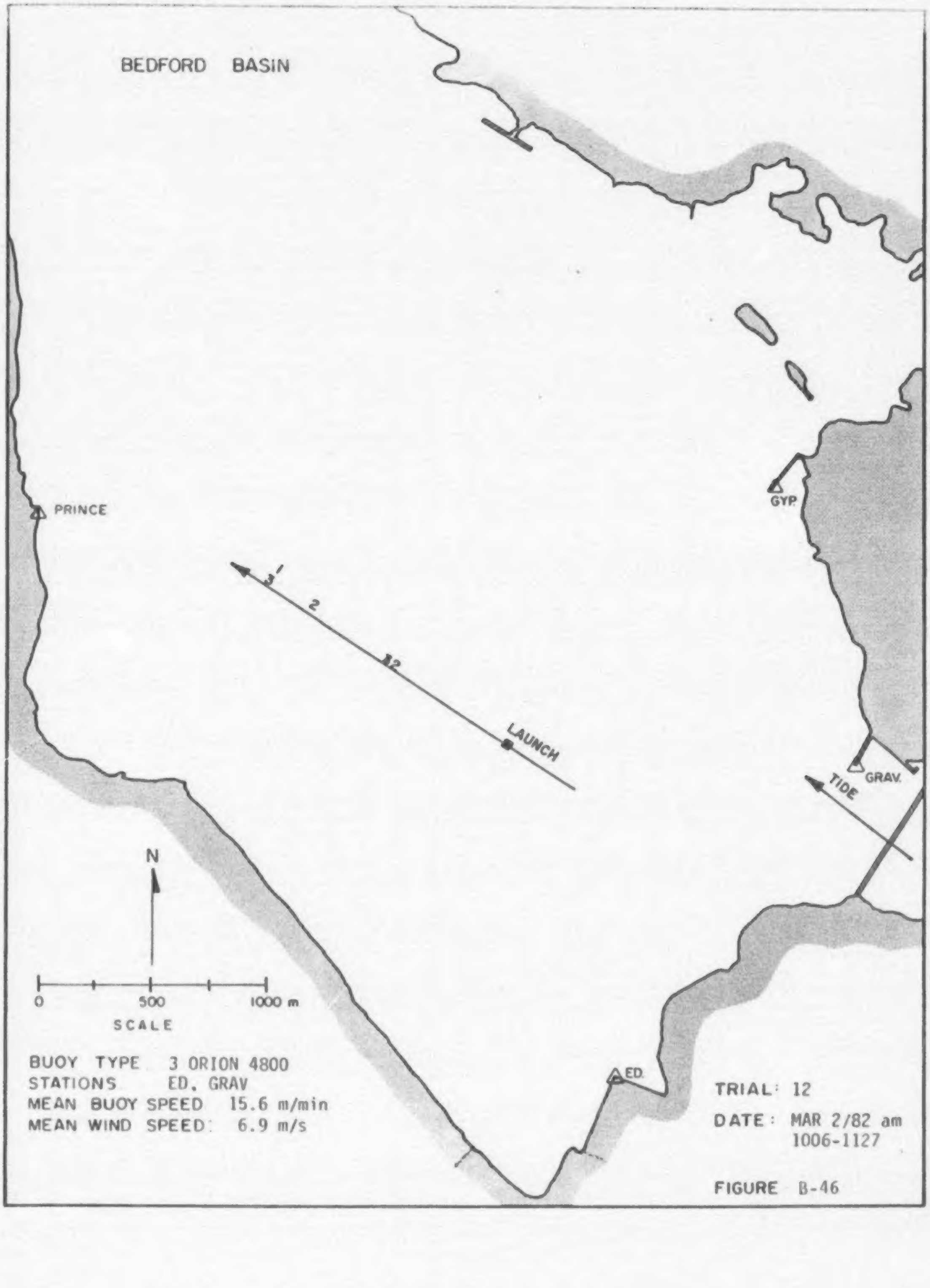
FIGURE B-44


BEDFORD BASIN
PRINCE
GYP.
GRAV.
ED.
TIDE
3
2
3
WIND 115° T
LAUNCH
N
0
500
1000 m
SCALE

BUOY TYPE 3 TAR BALL
STATIONS ED, GRAV
MEAN BUOY SPEED 15.8 m/min
MEAN WIND SPEED: 6.9 m/s

TRIAL: 12
DATE: MAR 2/82 am
1006-1127

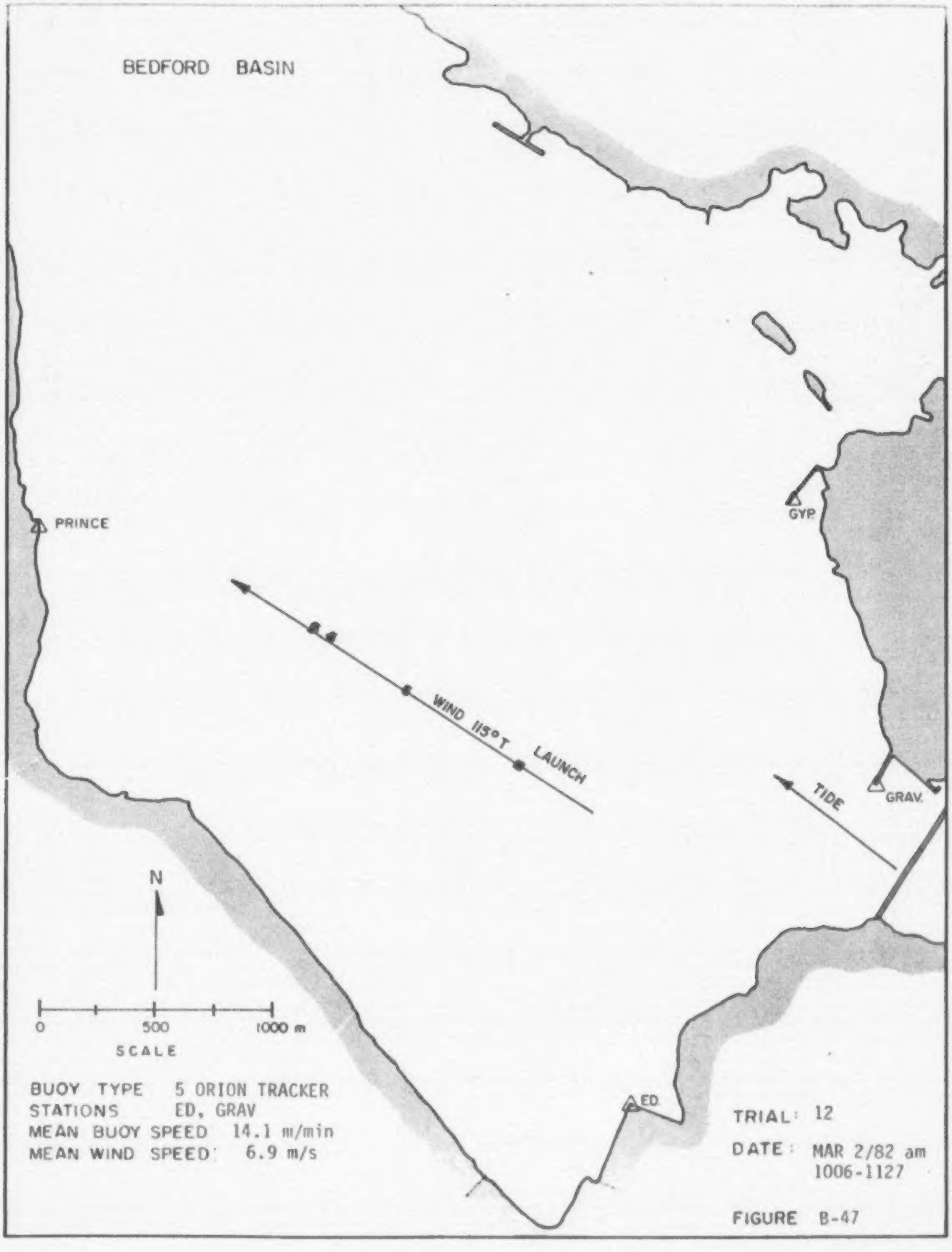
FIGURE B-45


BEDFORD BASIN
PRINCE
GYP.
GRAV.
ED.
TIDE
LAUNCH
1
3
2
12
N
0
500
1000 m
SCALE

BUOY TYPE 3 ORION 4800
STATIONS ED, GRAV
MEAN BUOY SPEED 15.6 m/min
MEAN WIND SPEED: 6.9 m/s

TRIAL: 12
DATE: MAR 2/82 am
1006-1127

FIGURE B-46

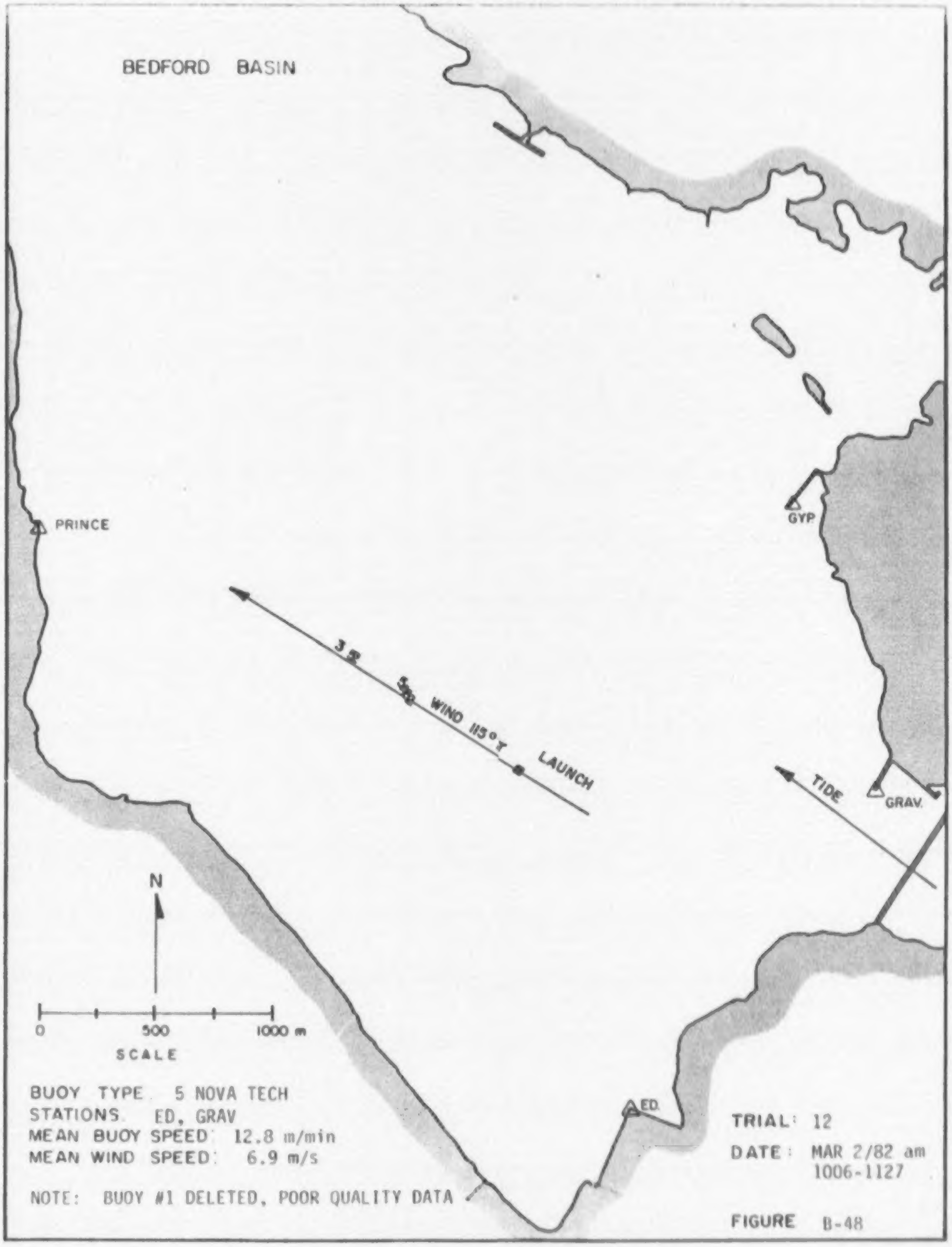

BEDFORD BASIN
PRINCE
GYP.
GRAV.
ED.
WIND 115°T
LAUNCH
TIDE
N
0
500
1000 m
SCALE

BUOY TYPE 5 ORION TRACKER
STATIONS ED, GRAV
MEAN BUOY SPEED 14.1 m/min
MEAN WIND SPEED: 6.9 m/s

TRIAL: 12

DATE: MAR 2/82 am
1006-1127

FIGURE B-47


BEDFORD BASIN
PRINCE
GYP
3
5
WIND 115° T
LAUNCH
TIDE
GRAV.
ED.
N
0
500
1000 m
SCALE

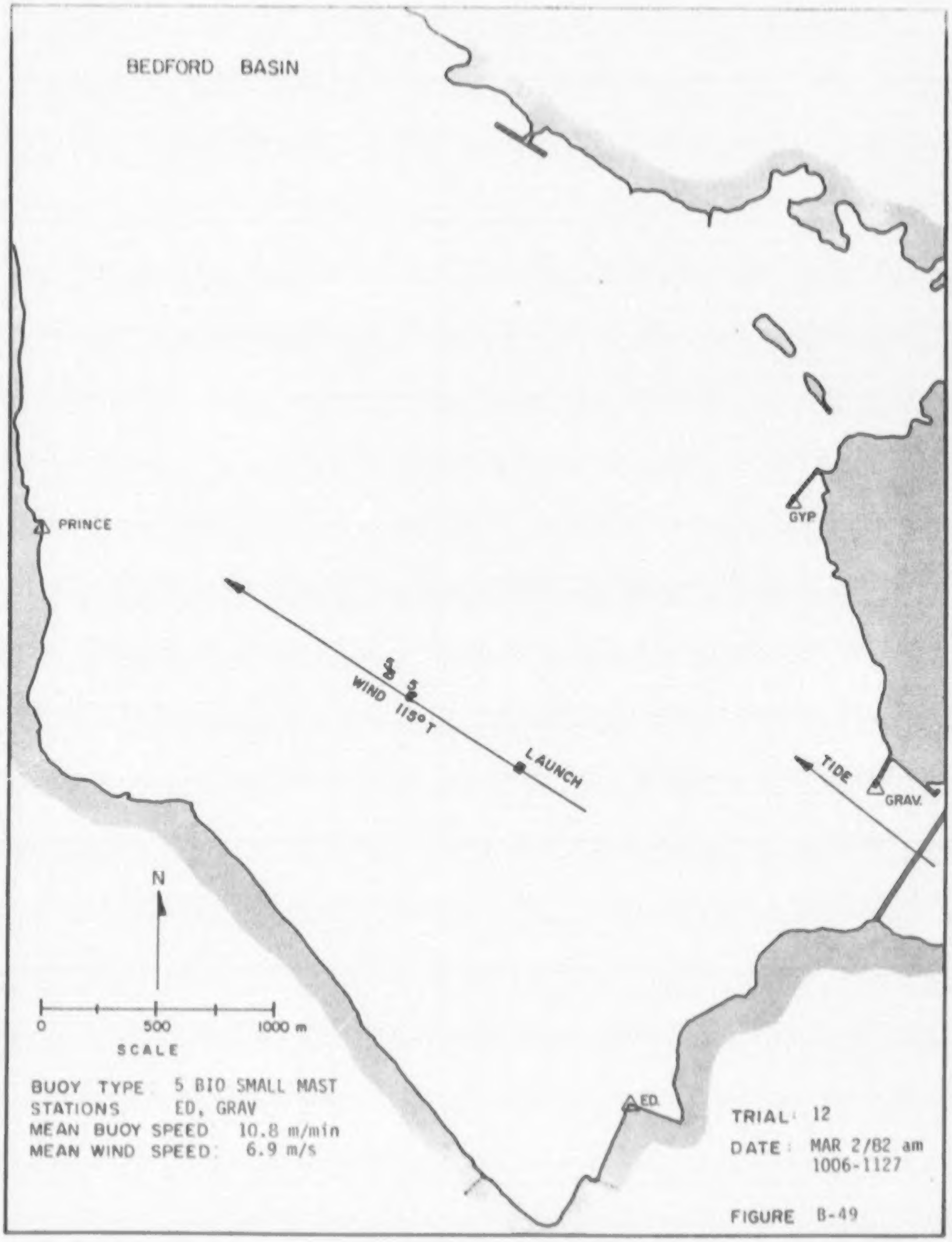
BUOY TYPE 5 NOVA TECH
STATIONS ED, GRAV
MEAN BUOY SPEED 12.8 m/min
MEAN WIND SPEED 6.9 m/s

NOTE: BUOY #1 DELETED, POOR QUALITY DATA

TRIAL: 12

DATE: MAR 2/82 am
1006-1127

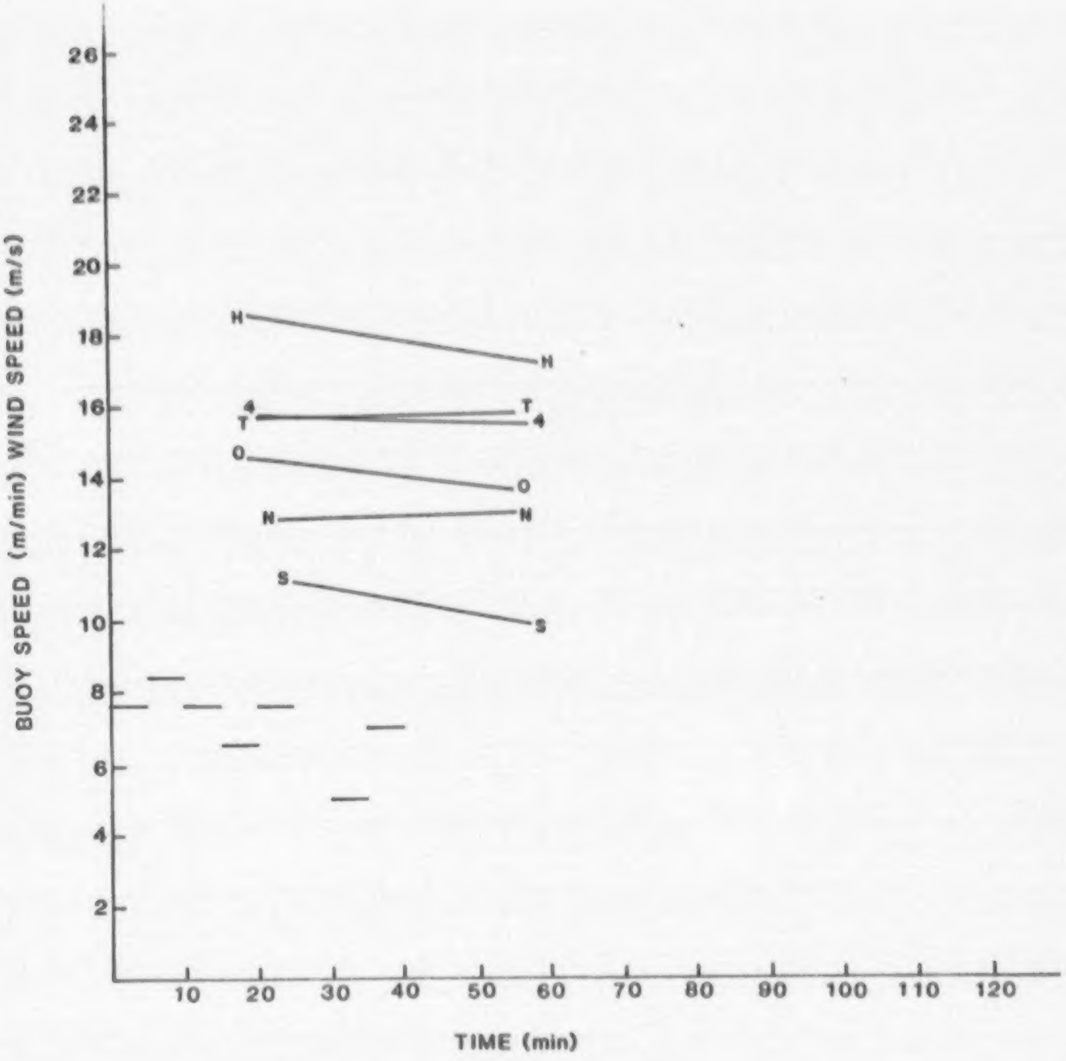
FIGURE B-48


BEDFORD BASIN
PRINCE
GYP
GRAV.
ED.
TIDE
WIND 115° T
LAUNCH
5
5
N
0
500
1000 m
SCALE

BUOY TYPE 5 BIO SMALL MAST
STATIONS ED, GRAV
MEAN BUOY SPEED 10.8 m/min
MEAN WIND SPEED: 6.9 m/s

TRIAL: 12
DATE: MAR 2/82 am
1006-1127

FIGURE B-49



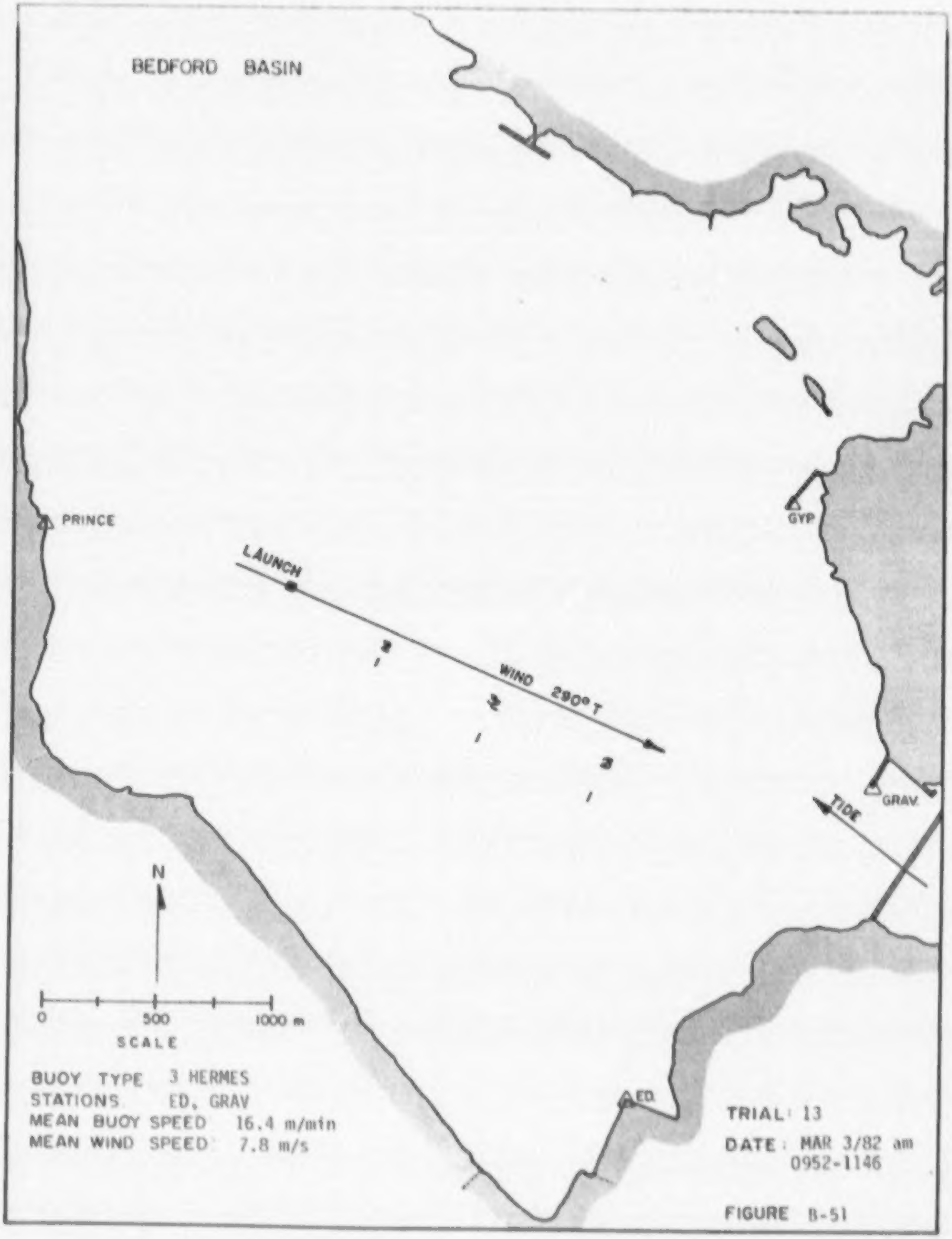
BUOY SPEED (ABSOLUTE, AT
TIME BETWEEN FIXES) Vs TIME (ELAPSED)

LEGEND

H - HERMES
T - TAR BALL
4 - ORION 4800
O - ORION TRACKER
N - NOVA TECH
S - BIO SMALL MAST
— — WIND

TRIAL : 12
DATE : MAR 2/82, 1006-1127
TIDE : LOW - 0725
HI - 1240

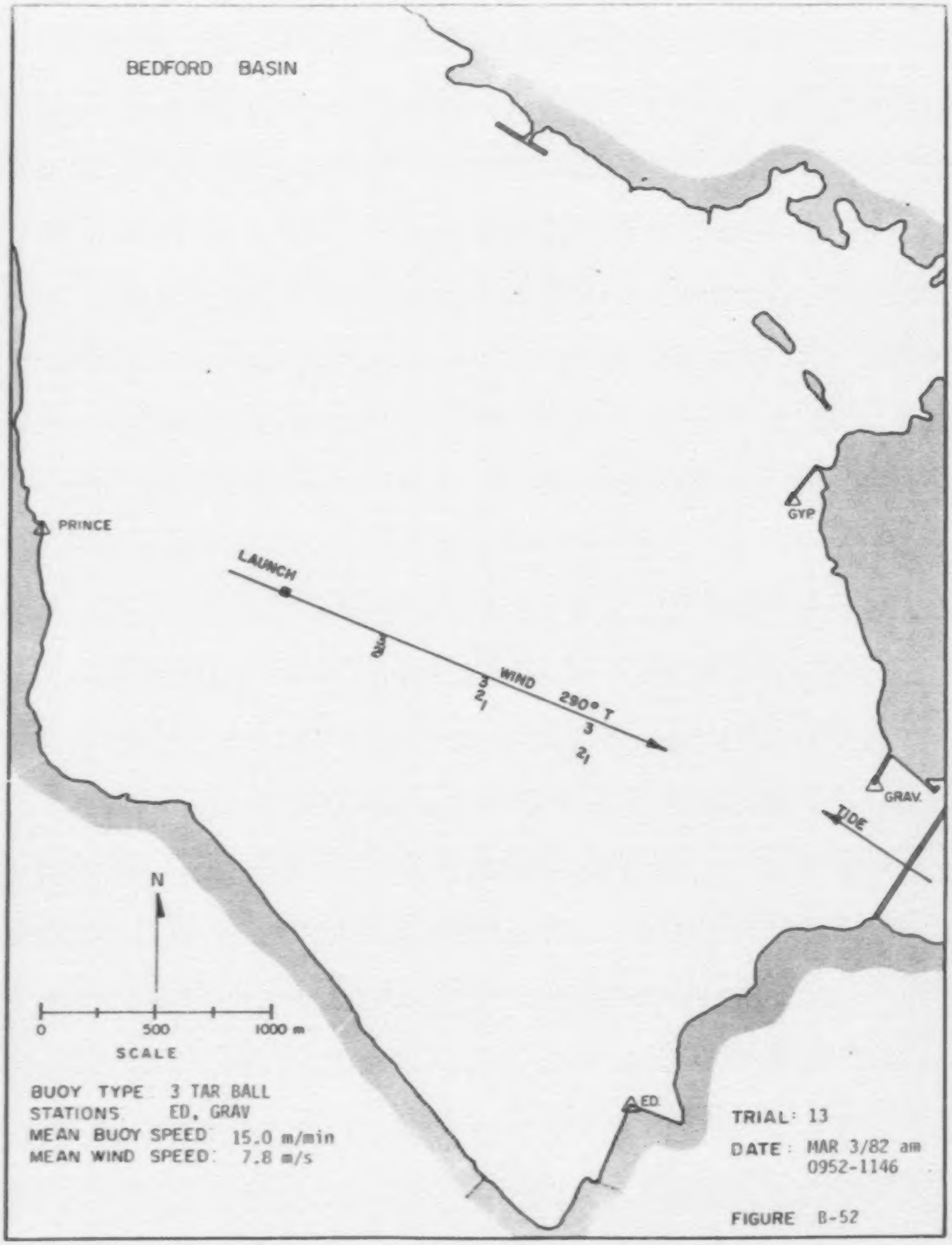
AV. WIND SPEED : 6.9 m/s
FIGURE : B-50


BEDFORD BASIN
PRINCE
GYP
LAUNCH
WIND 290° T
1
2
3
TIDE
GRAV.
ED.
N
0
500
1000 m
SCALE

BUOY TYPE 3 HERMES
STATIONS ED, GRAV
MEAN BUOY SPEED 16.4 m/min
MEAN WIND SPEED 7.8 m/s

TRIAL: 13
DATE: MAR 3/82 am
0952-1146

FIGURE B-51

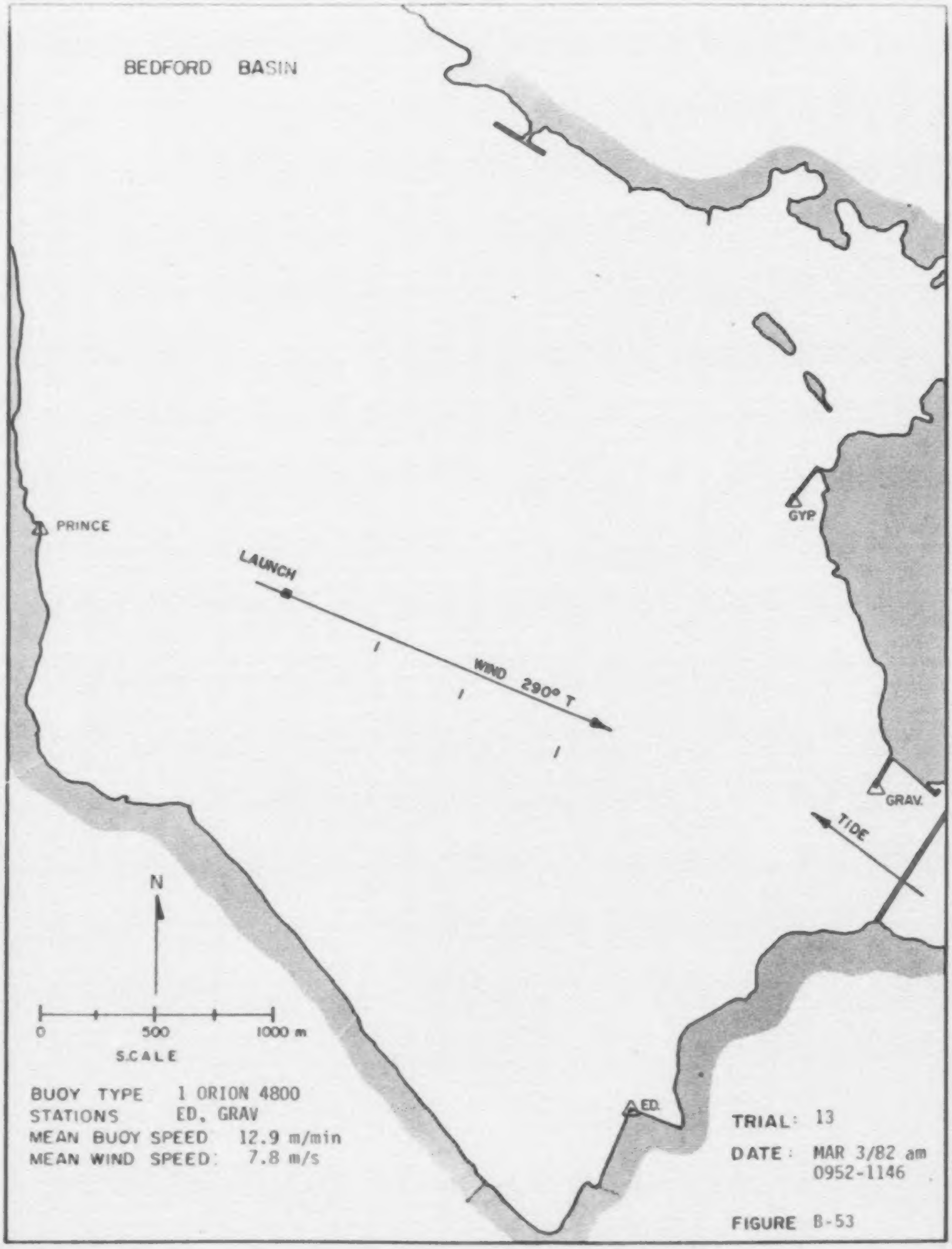

BEDFORD BASIN
PRINCE
GYP
LAUNCH
3
2
1
3
2
1
WIND 290° T
3
2
1
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 3 TAR BALL
STATIONS: ED, GRAV
MEAN BUOY SPEED: 15.0 m/min
MEAN WIND SPEED: 7.8 m/s

TRIAL: 13

DATE: MAR 3/82 am
0952-1146

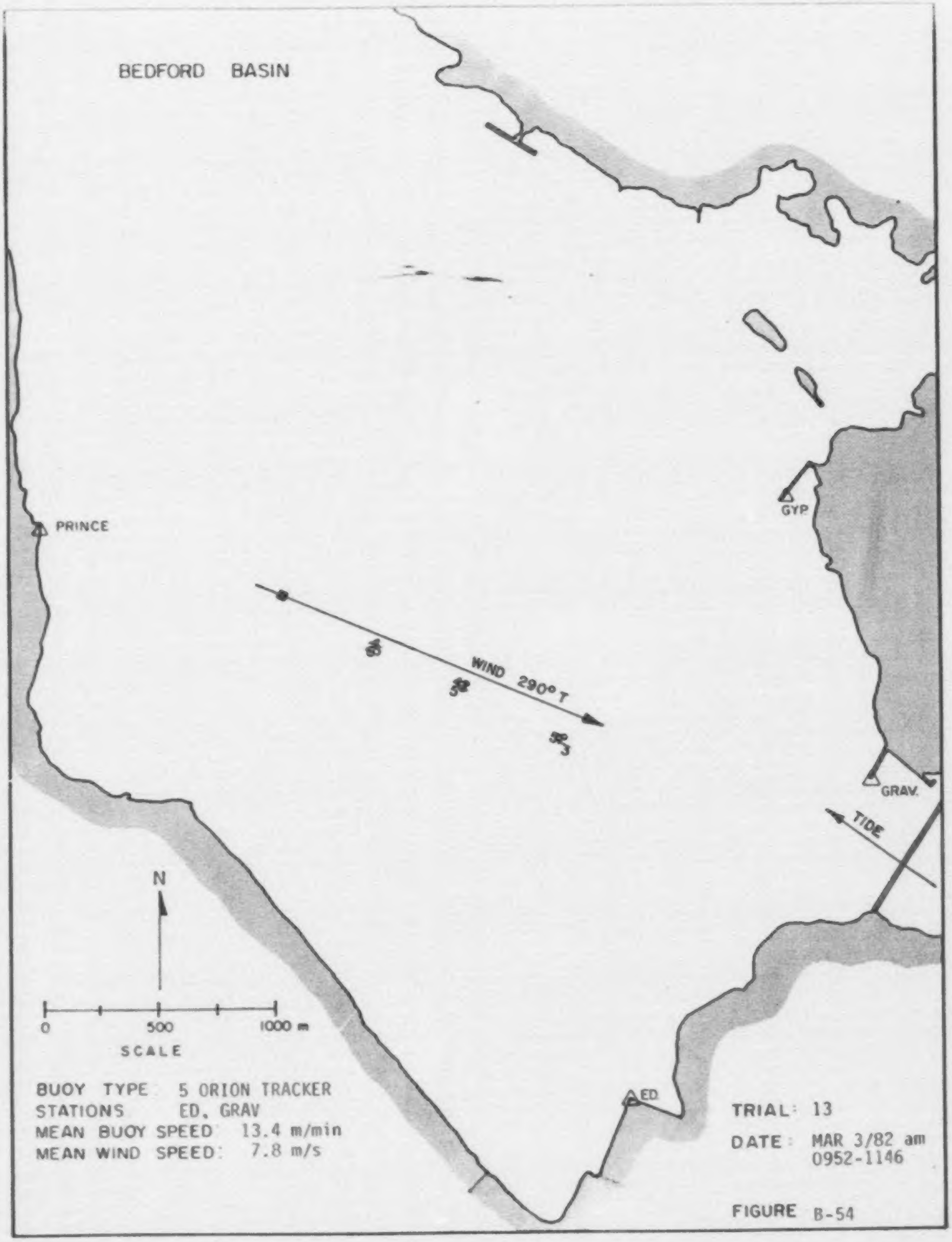
FIGURE B-52


BEDFORD BASIN
PRINCE
LAUNCH
WIND 290° T
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE 1 ORION 4800
STATIONS ED, GRAV
MEAN BUOY SPEED 12.9 m/min
MEAN WIND SPEED: 7.8 m/s

TRIAL: 13
DATE: MAR 3/82 am
0952-1146

FIGURE B-53

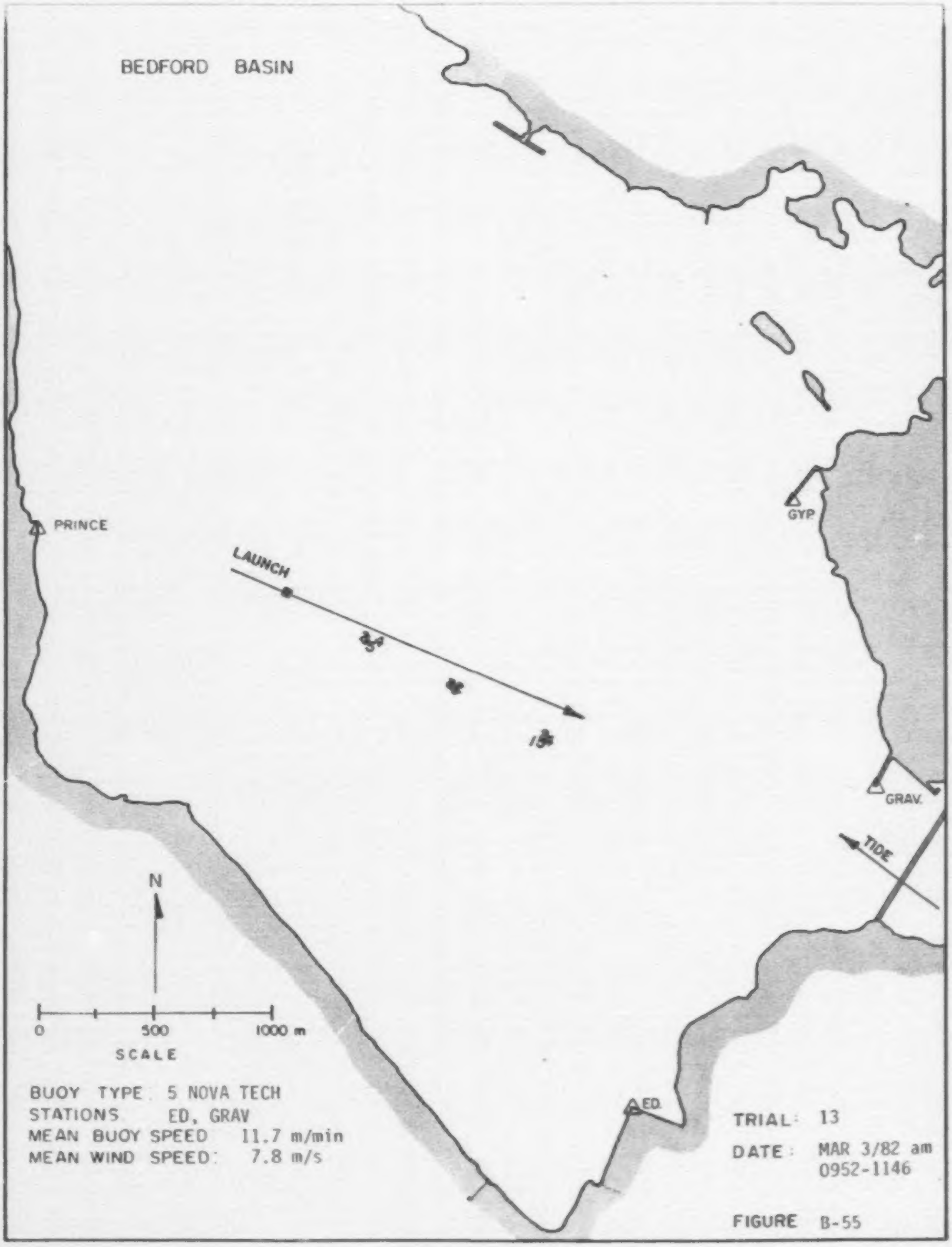

BEDFORD BASIN
PRINCE
GYP.
GRAV.
ED.
WIND 290° T
TIDE
N
0
500
1000 m
SCALE

BUOY TYPE 5 ORION TRACKER
STATIONS ED, GRAV
MEAN BUOY SPEED: 13.4 m/min
MEAN WIND SPEED: 7.8 m/s

TRIAL: 13

DATE: MAR 3/82 am
0952-1146

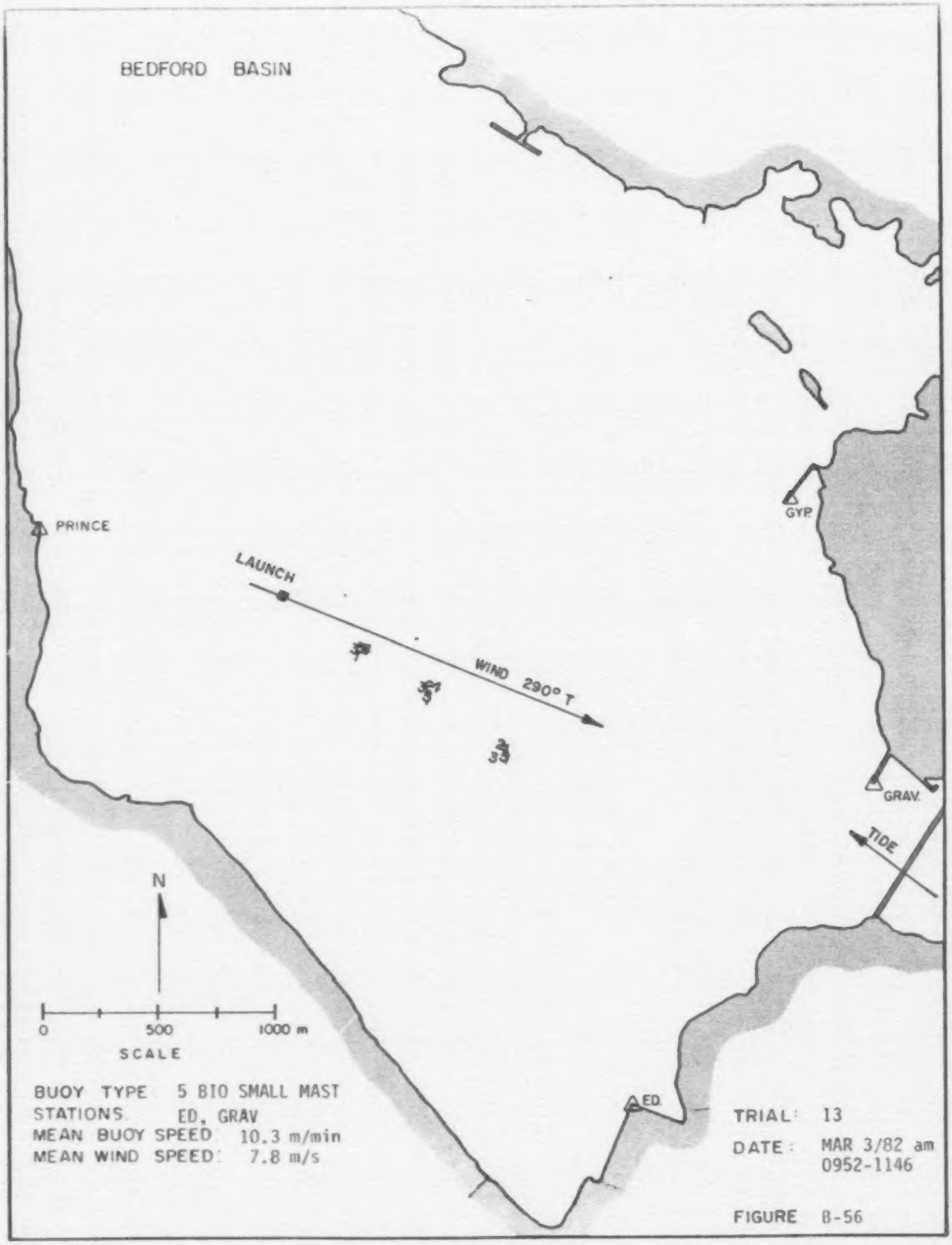
FIGURE B-54


BEDFORD BASIN
PRINCE
GYP.
LAUNCH
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 NOVA TECH
STATIONS: ED, GRAV
MEAN BUOY SPEED: 11.7 m/min
MEAN WIND SPEED: 7.8 m/s

TRIAL: 13
DATE: MAR 3/82 am
0952-1146

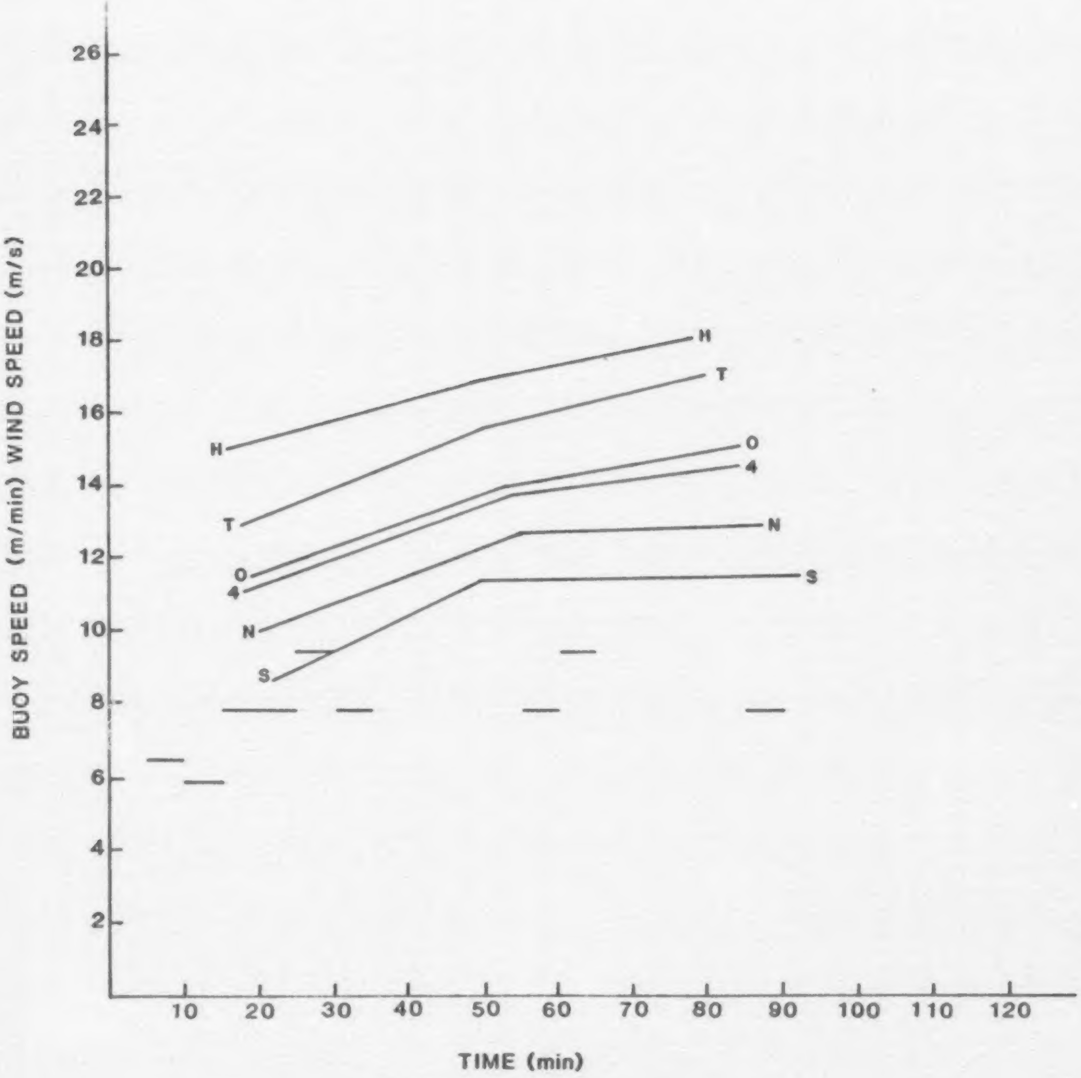
FIGURE B-55


BEDFORD BASIN
PRINCE
GYP.
GRAV.
ED.
LAUNCH
WIND 290° T
TIDE
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO SMALL MAST
STATIONS: ED, GRAV
MEAN BUOY SPEED: 10.3 m/min
MEAN WIND SPEED: 7.8 m/s

TRIAL: 13
DATE: MAR 3/82 am
0952-1146

FIGURE B-56

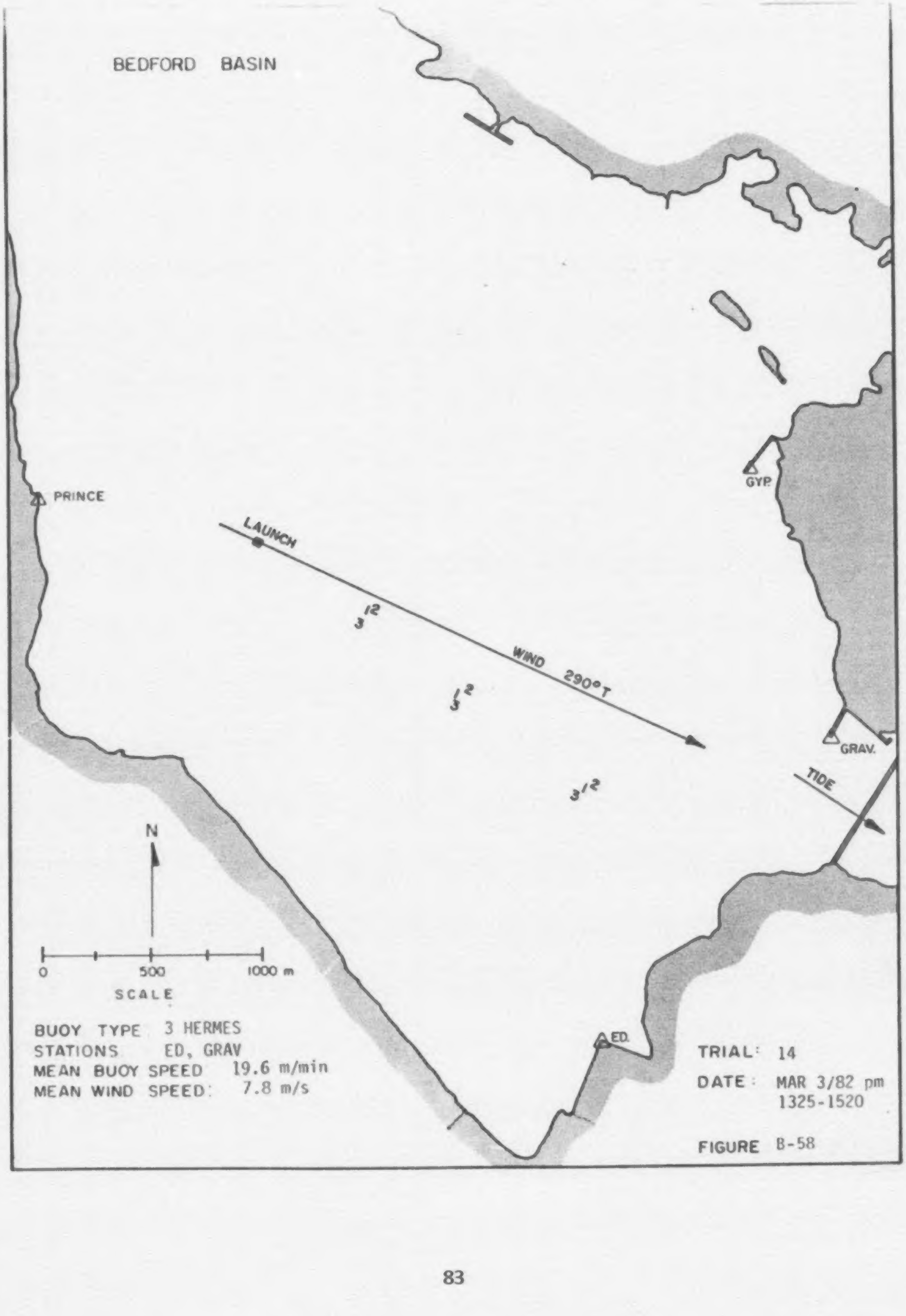


BUOY SPEED (ABSOLUTE, AT TIME BETWEEN FIXES) Vs TIME (ELAPSED)

LEGEND

H - HERMES
T - TAR BALL
O - ORION TRACKER
4 - ORION 4800
N - NOVA TECH
S - BIO SMALL MAST
— — WIND

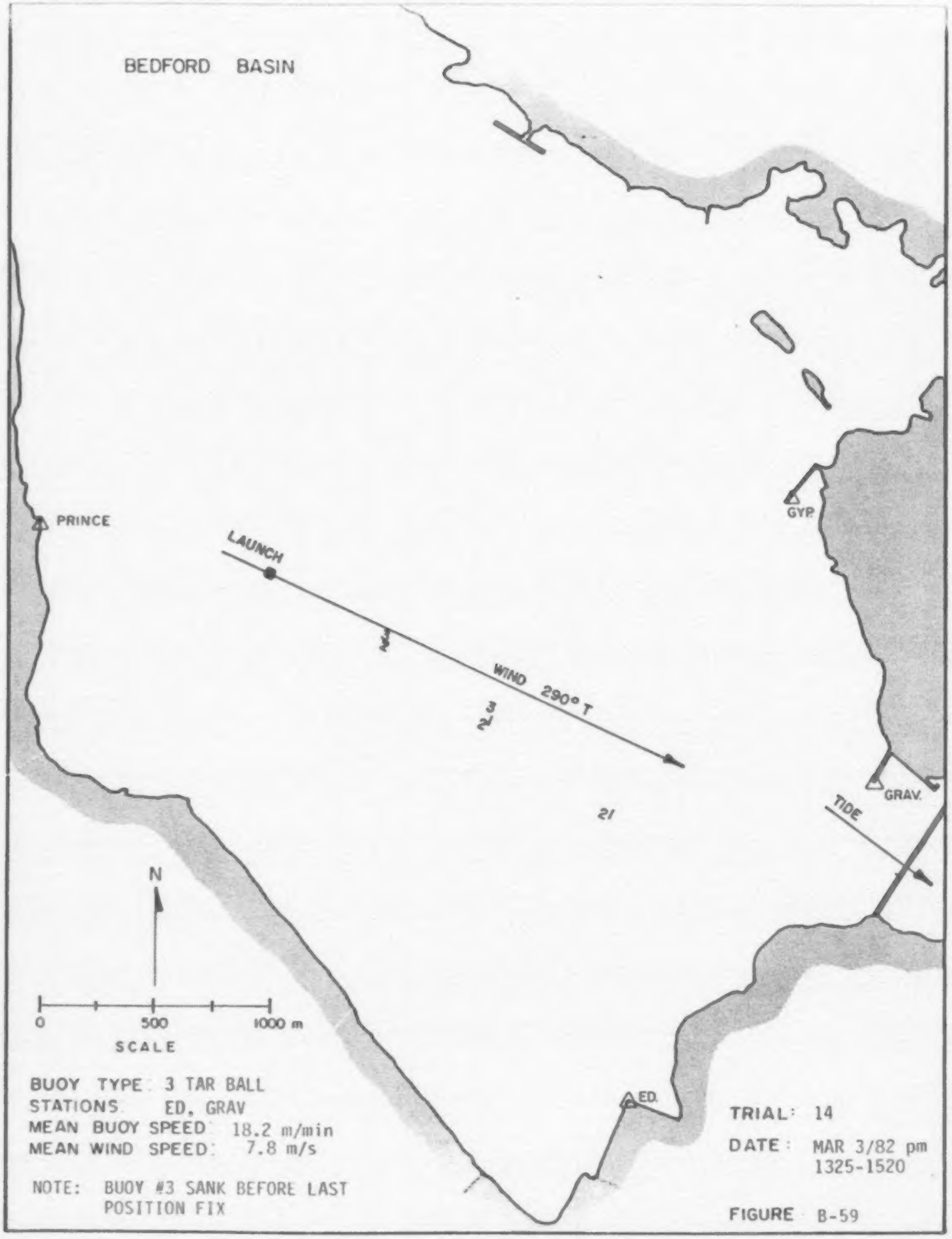
TRIAL :	13
DATE :	MAR 3/82, 0952-1146
TIDE :	LOW - 0840 HI - 1355
AV. WIND SPEED :	7.8 m/s
FIGURE :	B-57


BEDFORD BASIN
PRINCE
LAUNCH
WIND 290°T
GYP.
GRAV.
TIDE
ED.
3 1 2
3 1 2
3 1 2
N
0
500
1000 m
SCALE

BUOY TYPE 3 HERMES
STATIONS ED, GRAV
MEAN BUOY SPEED 19.6 m/min
MEAN WIND SPEED: 7.8 m/s

TRIAL: 14
DATE: MAR 3/82 pm
1325-1520

FIGURE B-58


BEDFORD BASIN
PRINCE
GYP.
GRAV.
ED.
LAUNCH
WIND 290° T
TIDE
1
2
3
2
3
2
21
N
0
500
1000 m
SCALE

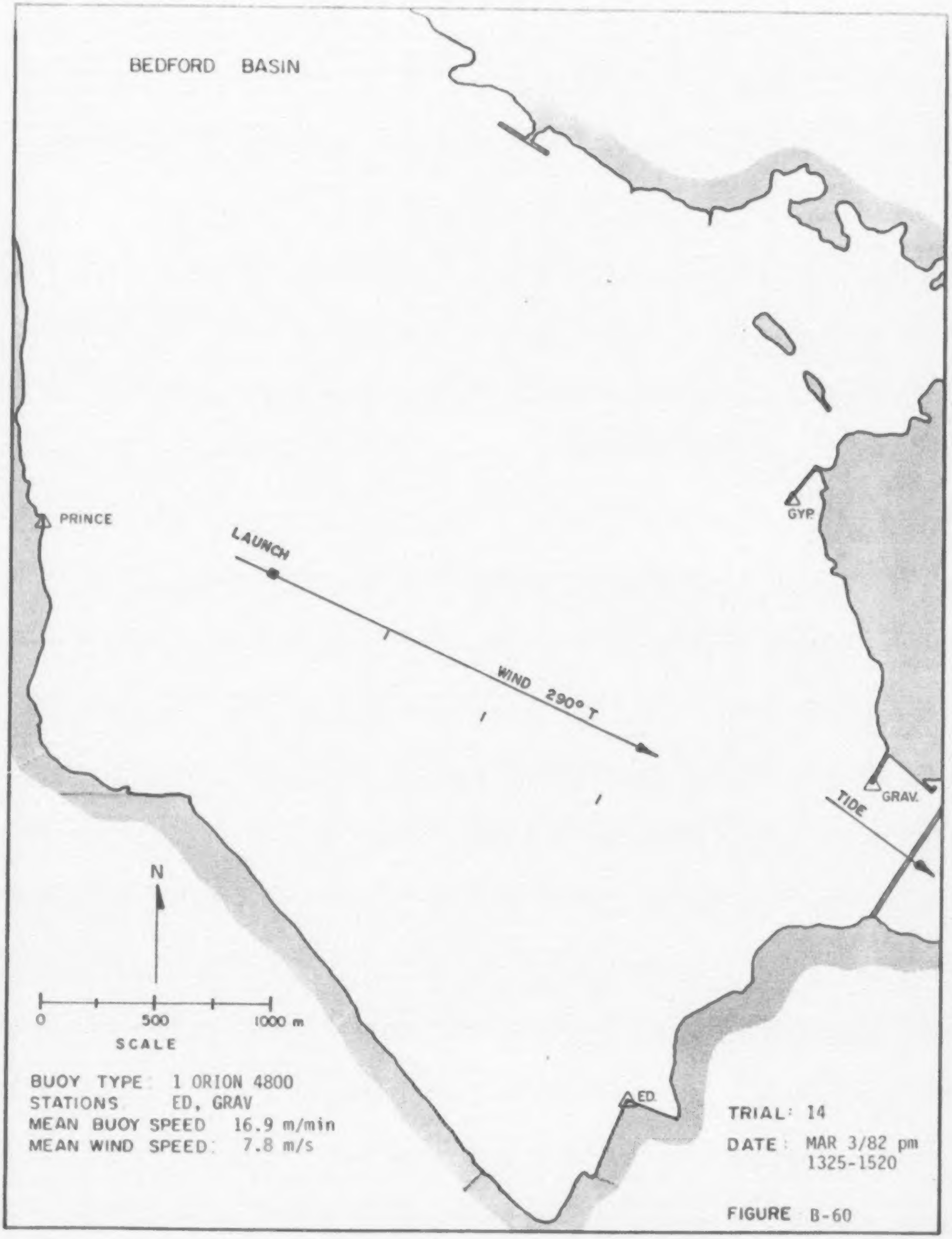
BUOY TYPE: 3 TAR BALL
STATIONS: ED, GRAV
MEAN BUOY SPEED: 18.2 m/min
MEAN WIND SPEED: 7.8 m/s

NOTE: BUOY #3 SANK BEFORE LAST POSITION FIX

TRIAL: 14

DATE: MAR 3/82 pm
1325-1520

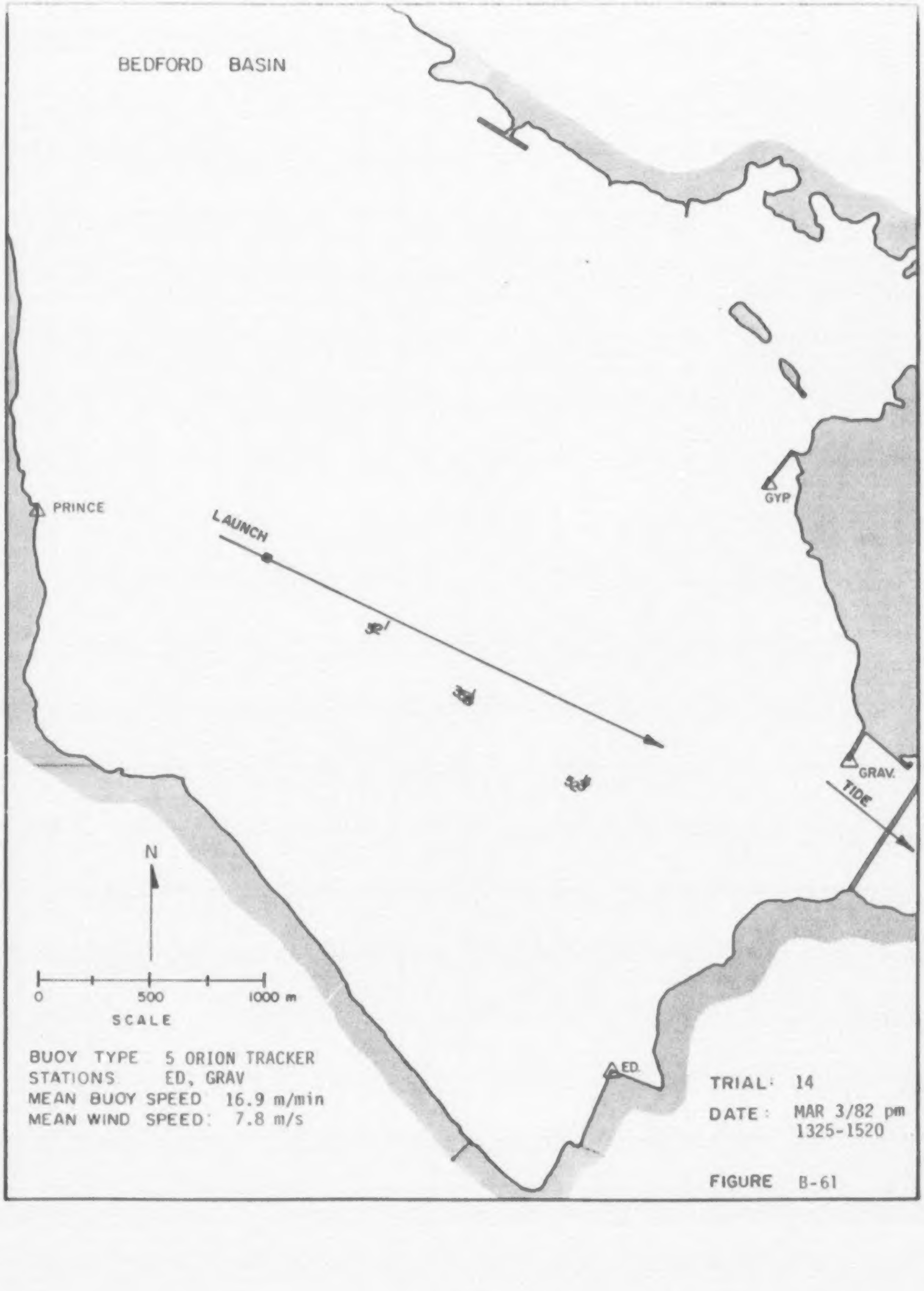
FIGURE B-59


BEDFORD BASIN
PRINCE
LAUNCH
WIND 290° T
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 1 ORION 4800
STATIONS: ED, GRAV
MEAN BUOY SPEED: 16.9 m/min
MEAN WIND SPEED: 7.8 m/s

TRIAL: 14
DATE: MAR 3/82 pm
1325-1520

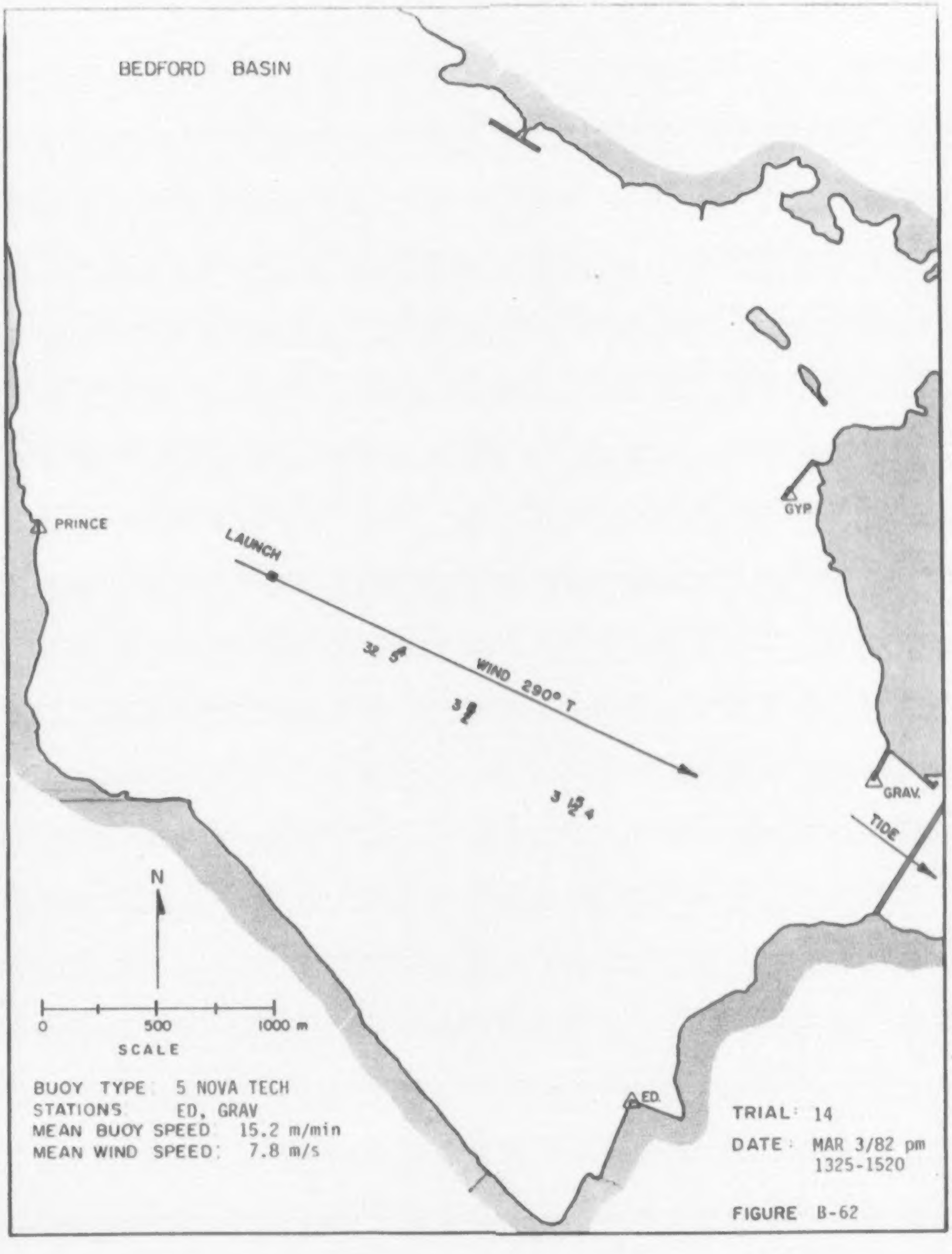
FIGURE B-60


BEDFORD BASIN
PRINCE
LAUNCH
GYP
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE 5 ORION TRACKER
STATIONS ED, GRAV
MEAN BUOY SPEED 16.9 m/min
MEAN WIND SPEED: 7.8 m/s

TRIAL: 14
DATE: MAR 3/82 pm
1325-1520

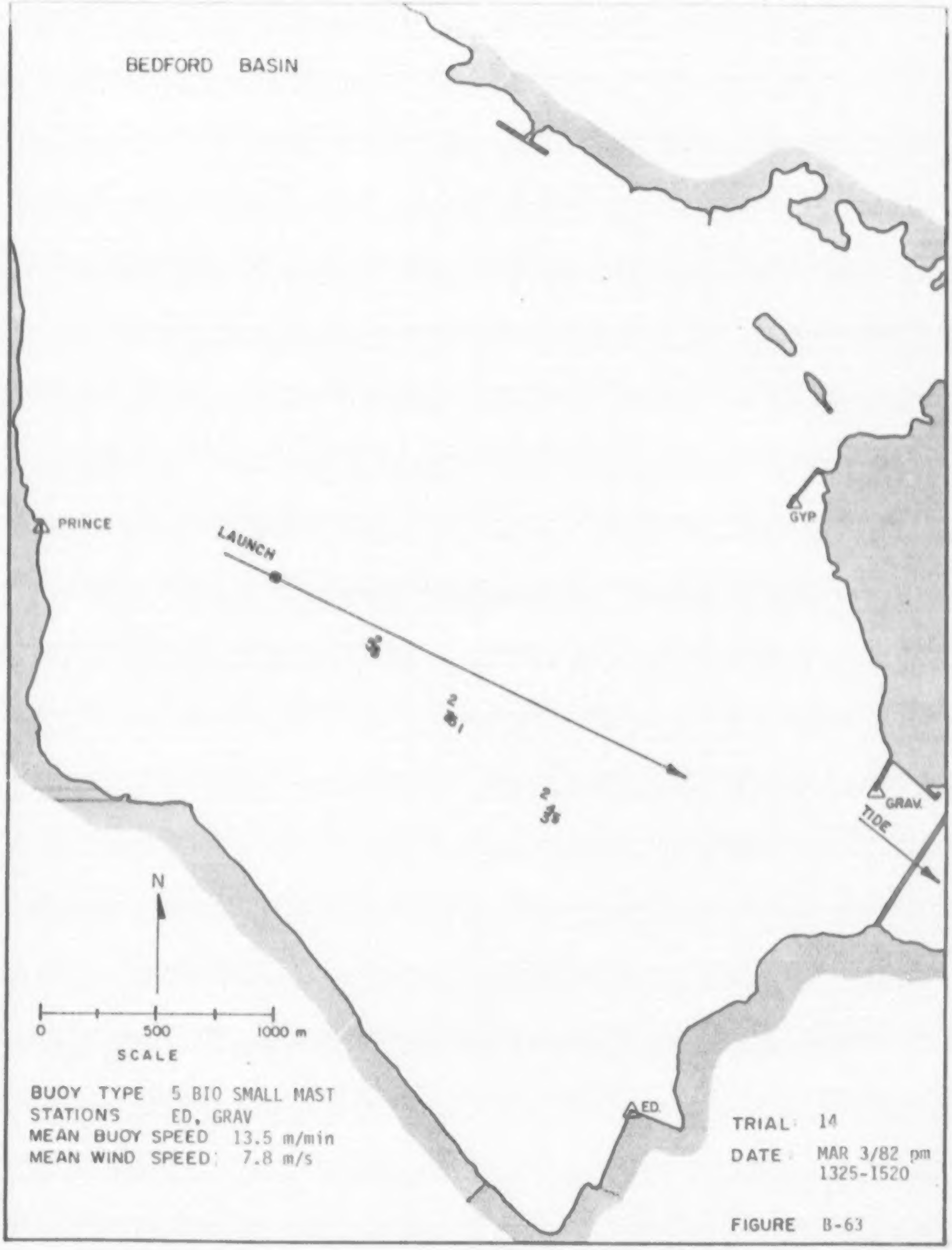
FIGURE B-61


BEDFORD BASIN
PRINCE
LAUNCH
WIND 290° T
GYP
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 NOVA TECH
STATIONS: ED, GRAV
MEAN BUOY SPEED: 15.2 m/min
MEAN WIND SPEED: 7.8 m/s

TRIAL: 14
DATE: MAR 3/82 pm
1325-1520

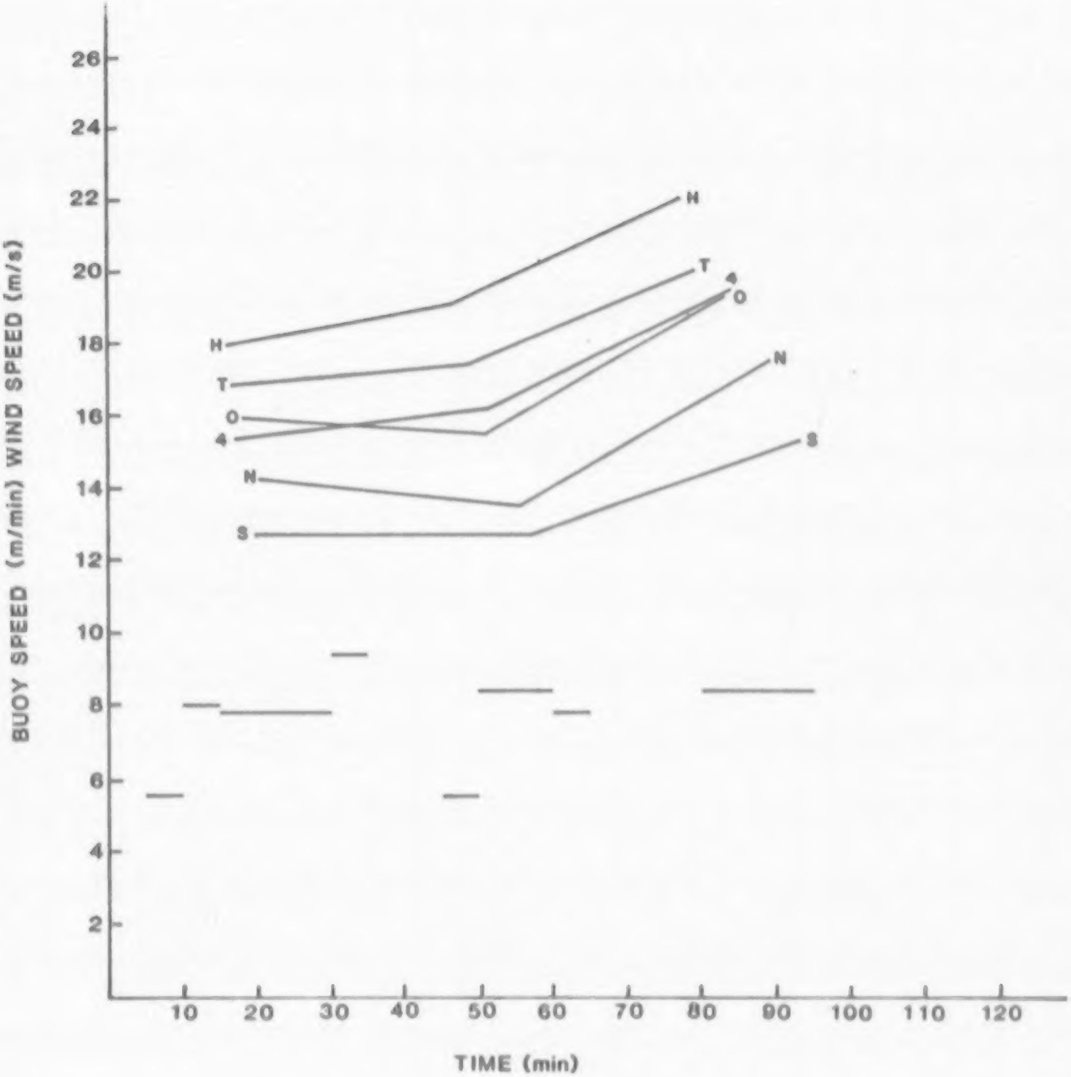
FIGURE B-62


BEDFORD BASIN
PRINCE
LAUNCH
GYP
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE 5 BIO SMALL MAST
STATIONS ED, GRAV
MEAN BUOY SPEED 13.5 m/min
MEAN WIND SPEED 7.8 m/s

TRIAL 14
DATE MAR 3/82 pm
1325-1520

FIGURE B-63

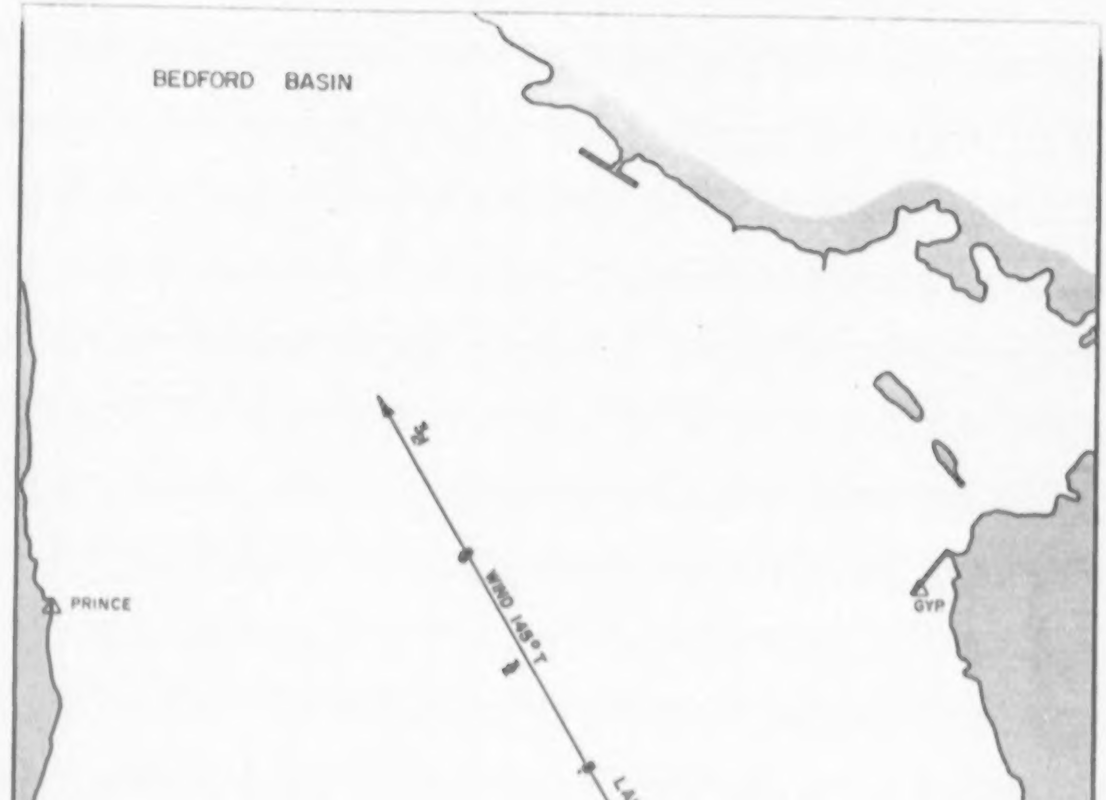


BUOY SPEED (ABSOLUTE, AT
TIME BETWEEN FIXES) Vs TIME (ELAPSED)

LEGEND

H - HERMES
T - TAR BALL
O - ORION TRACKER
4 - ORION 4800
N - NOVA TECH
S - BIO SMALL MAST
— — WIND

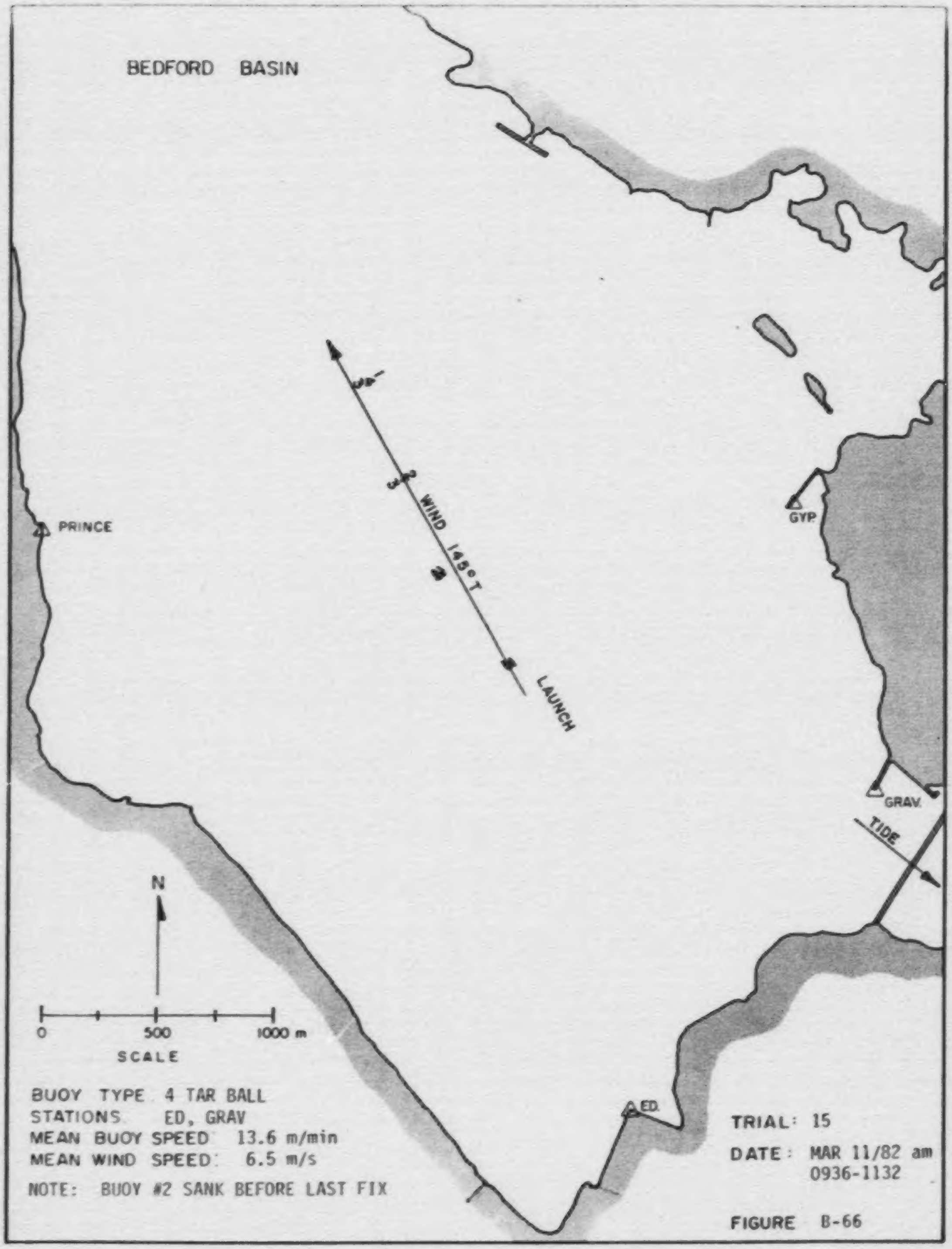
TRIAL : 14
DATE : MAR 3/82, 1325-1520
TIDE : HI - 1355
LOW - 2100
AV. WIND SPEED : 7.8 m/s
FIGURE : B-64


BEDFORD BASIN
PRINCE
GYP
GRAV.
ED.
TIDE
WIND 145° T
LAUNCH
N
0
500
1000 m
SCALE

BUOY TYPE: 3 HERMES
STATIONS: ED, GRAV
MEAN BUOY SPEED: 14.9 m/min
MEAN WIND SPEED: 6.5 m/s

TRIAL: 15
DATE: MAR 11/82 am
0936-1132

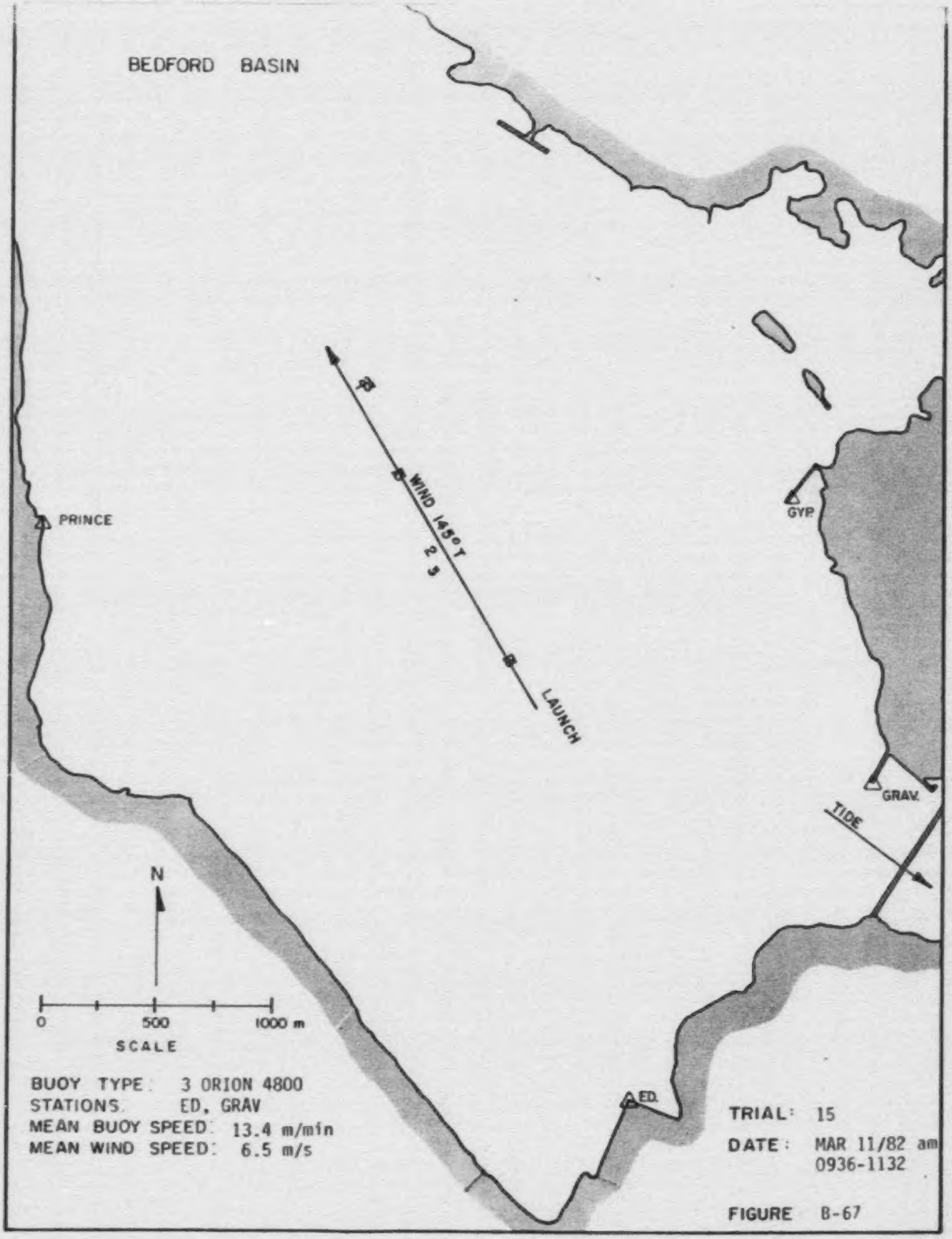
FIGURE B-65


BEDFORD BASIN
PRINCE
GYP.
GRAV.
TIDE
ED.
2
3
2
WIND 145°T
2
LAUNCH
N
0
500
1000 m
SCALE

BUOY TYPE 4 TAR BALL
STATIONS ED, GRAV
MEAN BUOY SPEED 13.6 m/min
MEAN WIND SPEED 6.5 m/s
NOTE: BUOY #2 SANK BEFORE LAST FIX

TRIAL: 15
DATE: MAR 11/82 am
0936-1132

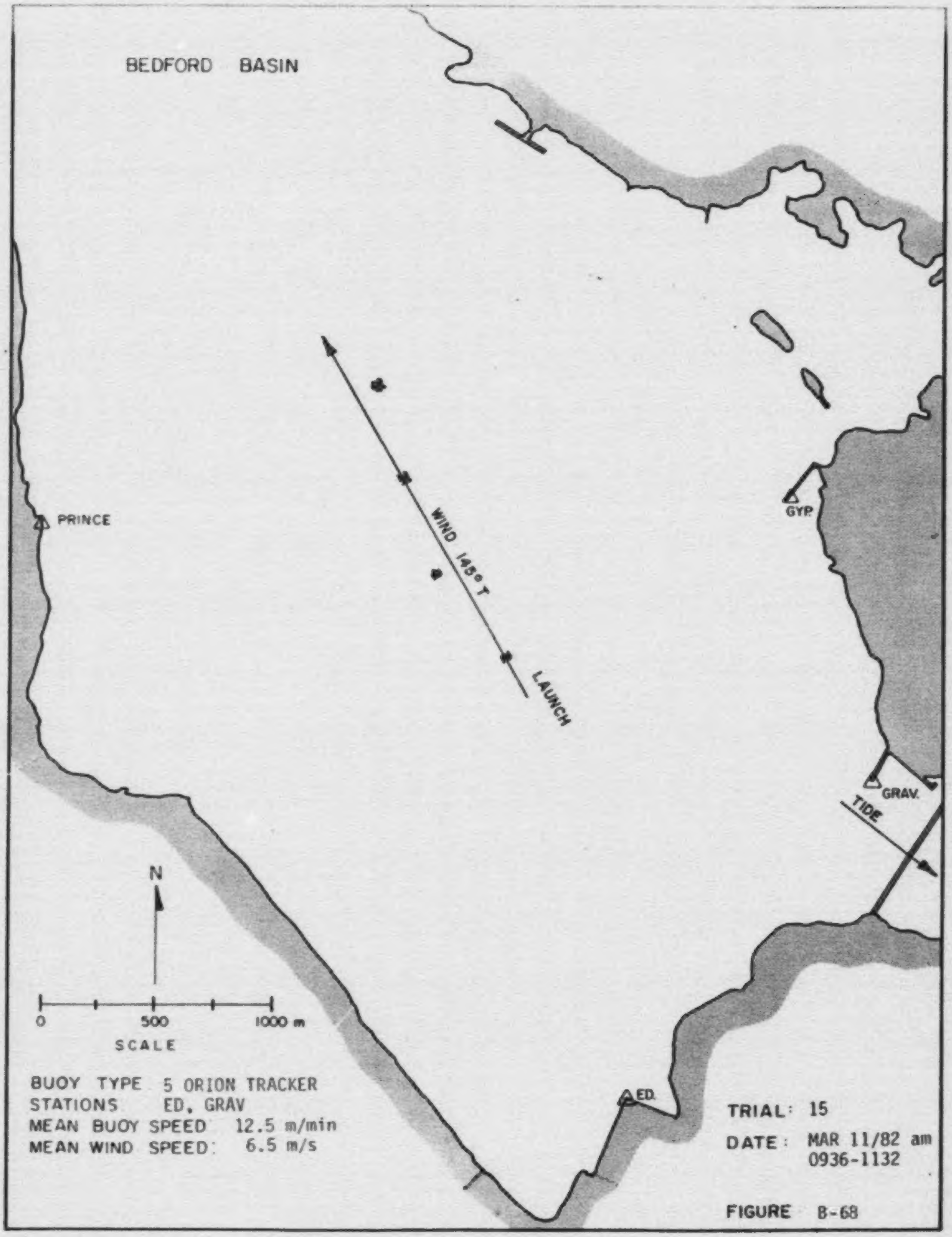
FIGURE B-66


BEDFORD BASIN
PRINCE
GYP.
GRAV.
ED.
TIDE
WIND 145° T
2 3
LAUNCH
N
0
500
1000 m
SCALE

BUOY TYPE: 3 ORION 4800
STATIONS: ED, GRAV
MEAN BUOY SPEED: 13.4 m/min
MEAN WIND SPEED: 6.5 m/s

TRIAL: 15
DATE: MAR 11/82 am
0936-1132

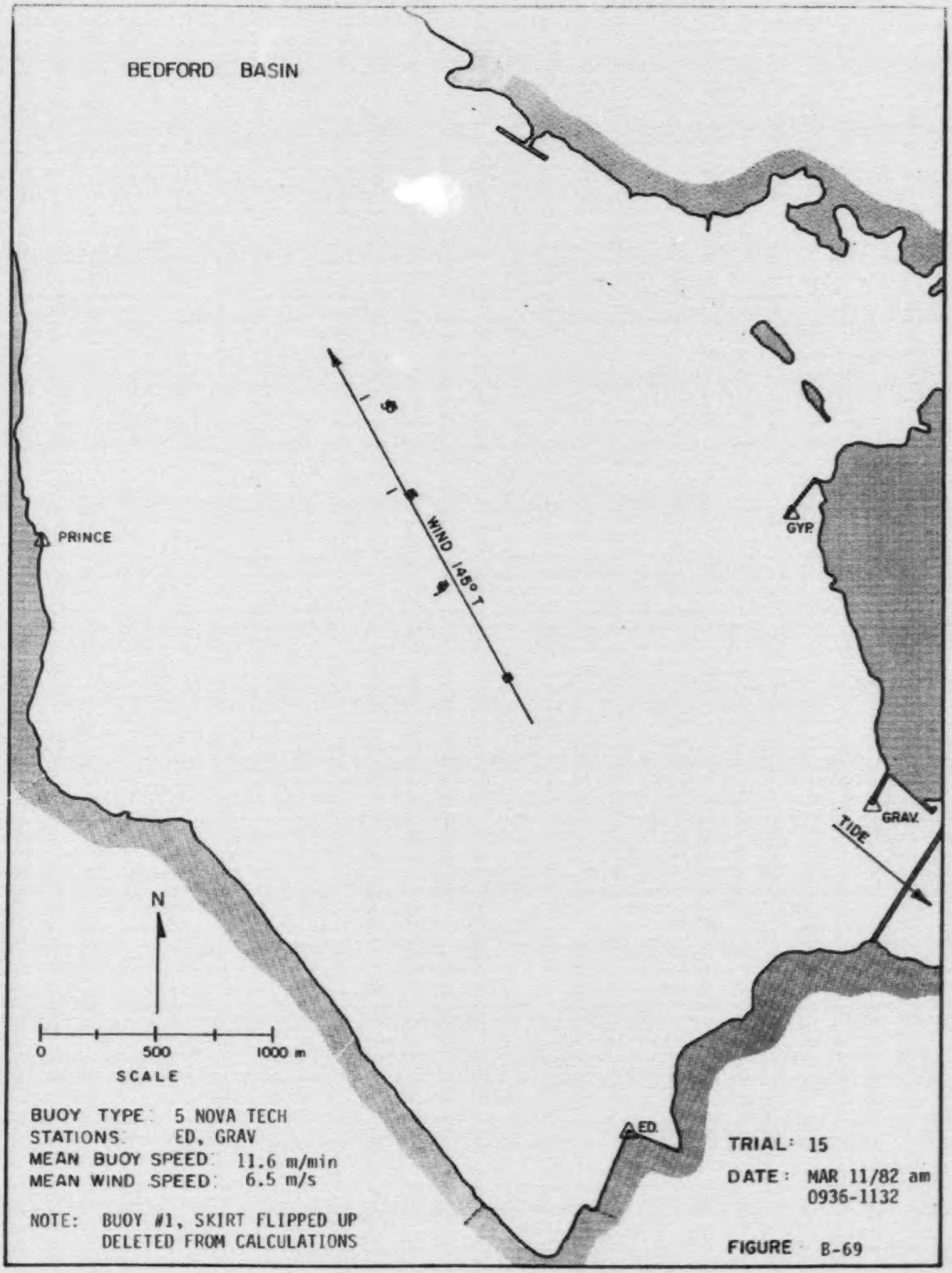
FIGURE B-67


BEDFORD BASIN
PRINCE
GYP.
GRAV.
TIDE
ED.
WIND 145° T
LAUNCH
N
0
500
1000 m
SCALE

BUOY TYPE 5 ORION TRACKER
STATIONS ED, GRAV
MEAN BUOY SPEED 12.5 m/min
MEAN WIND SPEED: 6.5 m/s

TRIAL: 15
DATE: MAR 11/82 am
0936-1132

FIGURE B-68


BEDFORD BASIN
PRINCE
GYP.
GRAV.
ED.
WIND 148° T
TIDE
N
0
500
1000 m
SCALE

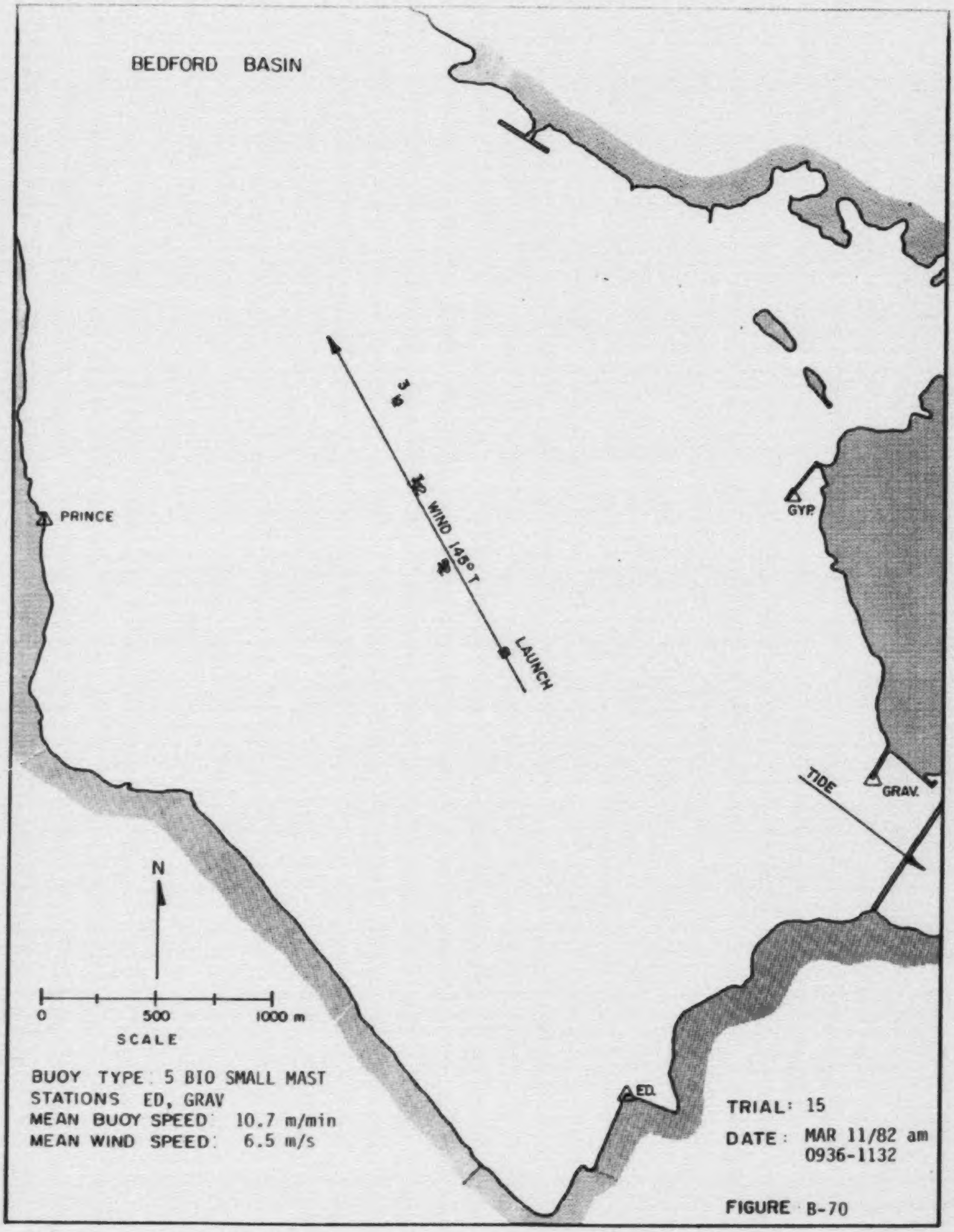
BUOY TYPE: 5 NOVA TECH
STATIONS: ED, GRAV
MEAN BUOY SPEED: 11.6 m/min
MEAN WIND SPEED: 6.5 m/s

NOTE: BUOY #1, SKIRT FLIPPED UP
DELETED FROM CALCULATIONS

TRIAL: 15

DATE: MAR 11/82 am
0936-1132

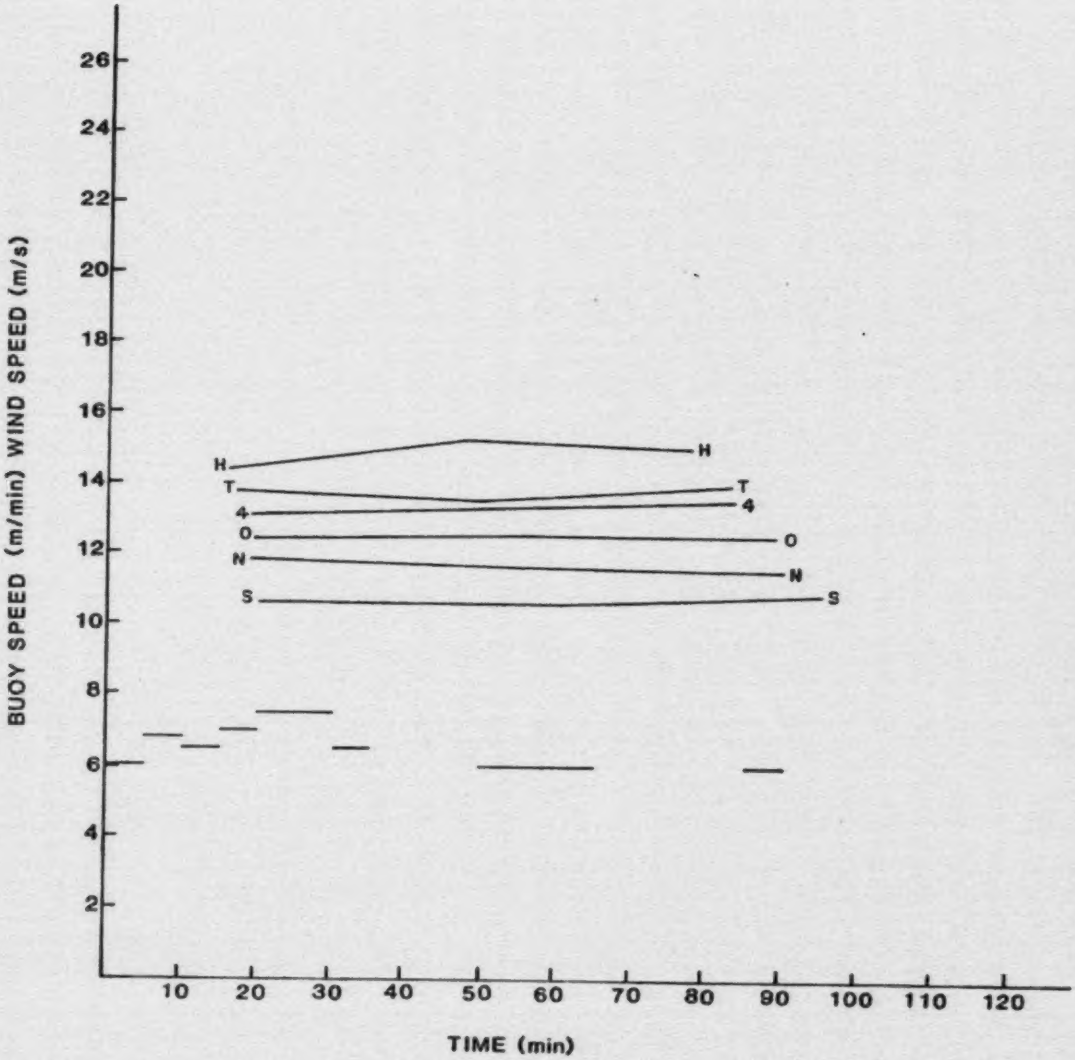
FIGURE B-69


BEDFORD BASIN
PRINCE
GYP.
GRAV.
TIDE
ED.
WIND 145° T
LAUNCH
3
1
2
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO SMALL MAST
STATIONS: ED, GRAV
MEAN BUOY SPEED: 10.7 m/min
MEAN WIND SPEED: 6.5 m/s

TRIAL: 15
DATE: MAR 11/82 am
0936-1132

FIGURE B-70

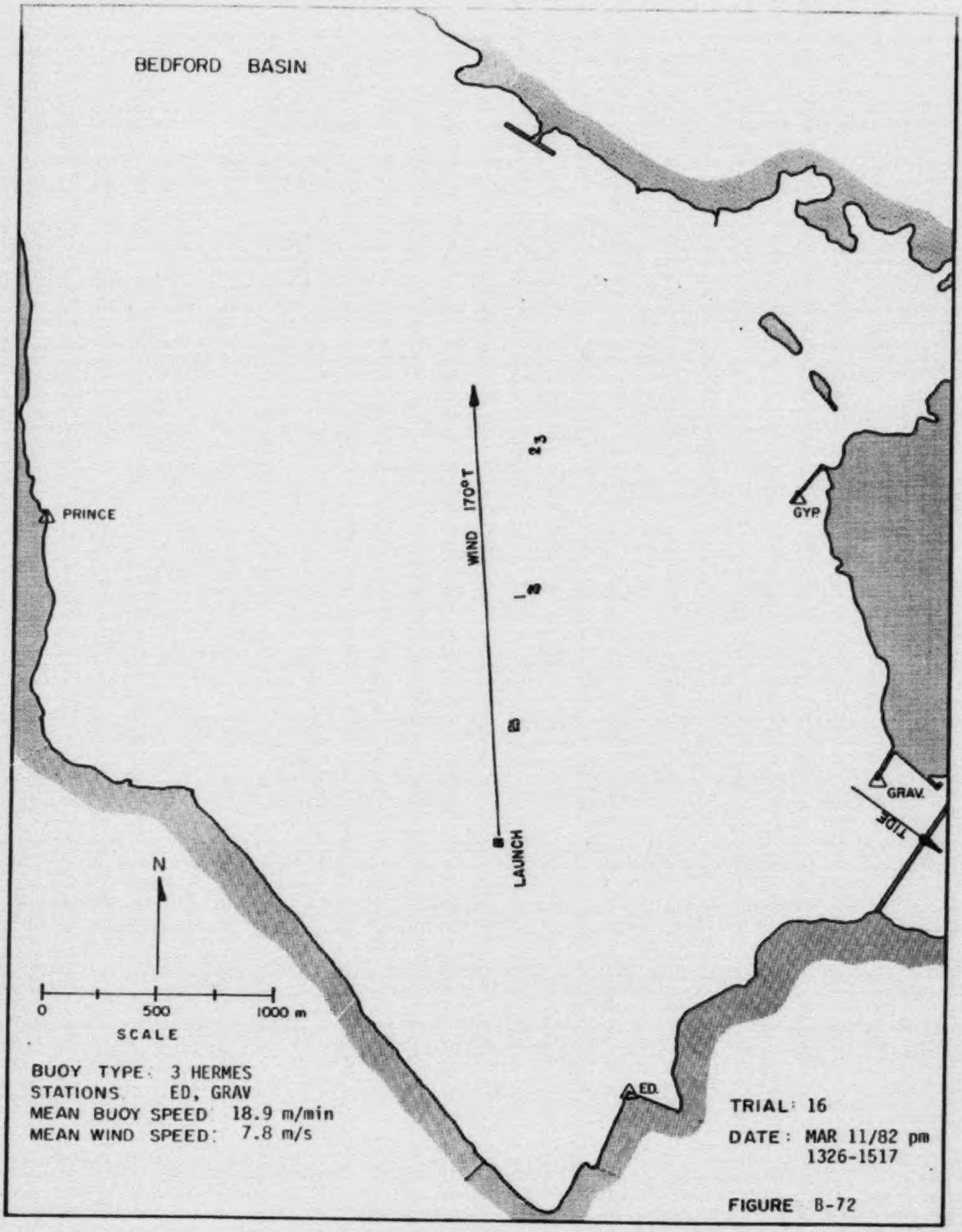


BUOY SPEED (ABSOLUTE, AT TIME BETWEEN FIXES) Vs TIME (ELAPSED)

LEGEND

H - HERMES
T - TAR BALL
4 - ORION 4800
O - ORION TRACKER
N - NOVA TECH
S - BIO SMALL MAST
— — WIND

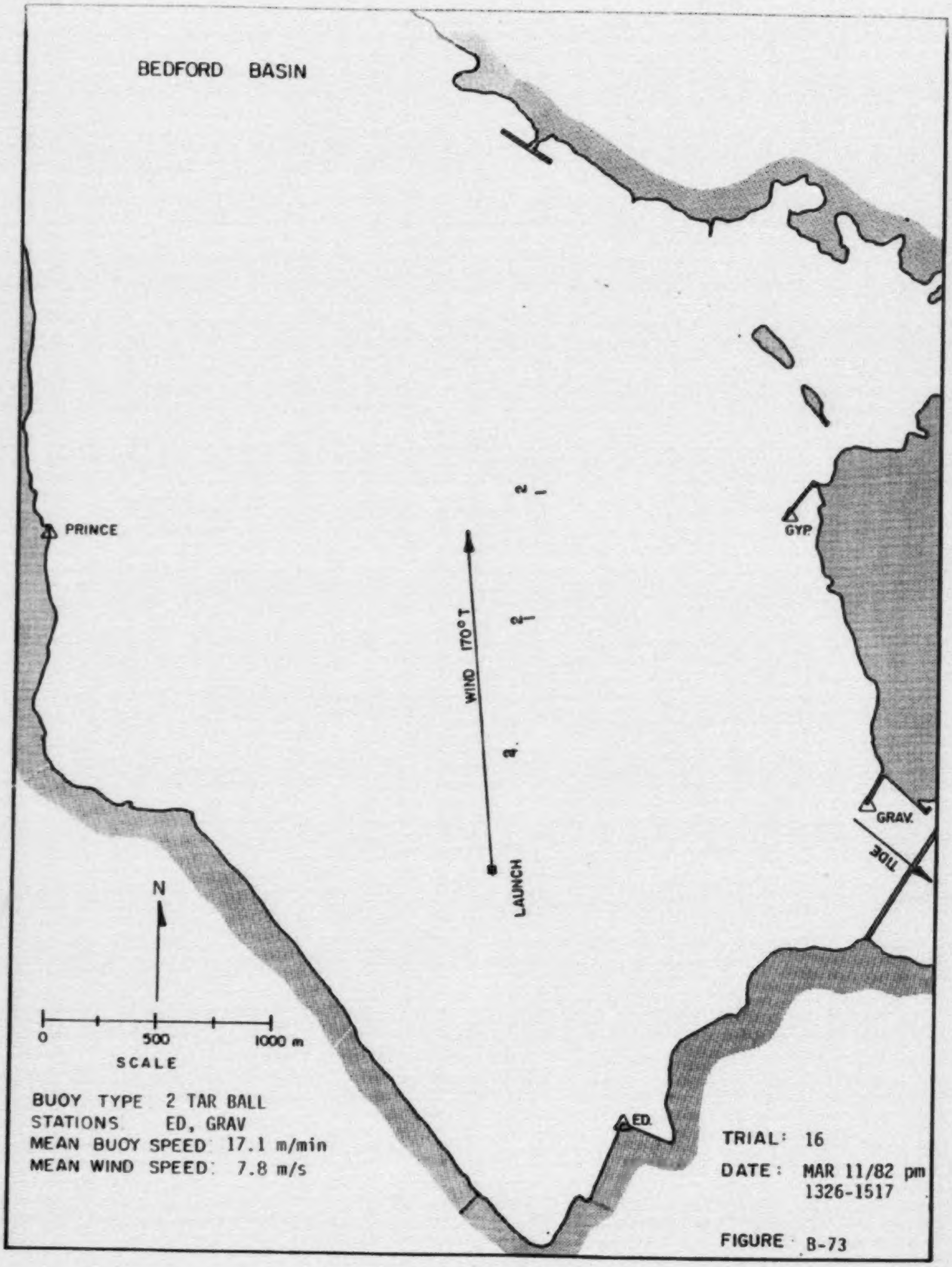
TRIAL : 15
DATE : MAR 11/82, 0936-1132
TIDE : HI - 0905
LOW - 1530
AV. WIND SPEED : 6.5 m/s
FIGURE : B 71


BEDFORD BASIN
PRINCE
GYP.
GRAV.
TIDE
ED.
WIND 170°T
LAUNCH
2 3
1
N
0
500
1000 m
SCALE

BUOY TYPE: 3 HERMES
STATIONS: ED, GRAV
MEAN BUOY SPEED: 18.9 m/min
MEAN WIND SPEED: 7.8 m/s

TRIAL: 16
DATE: MAR 11/82 pm
1326-1517

FIGURE B-72

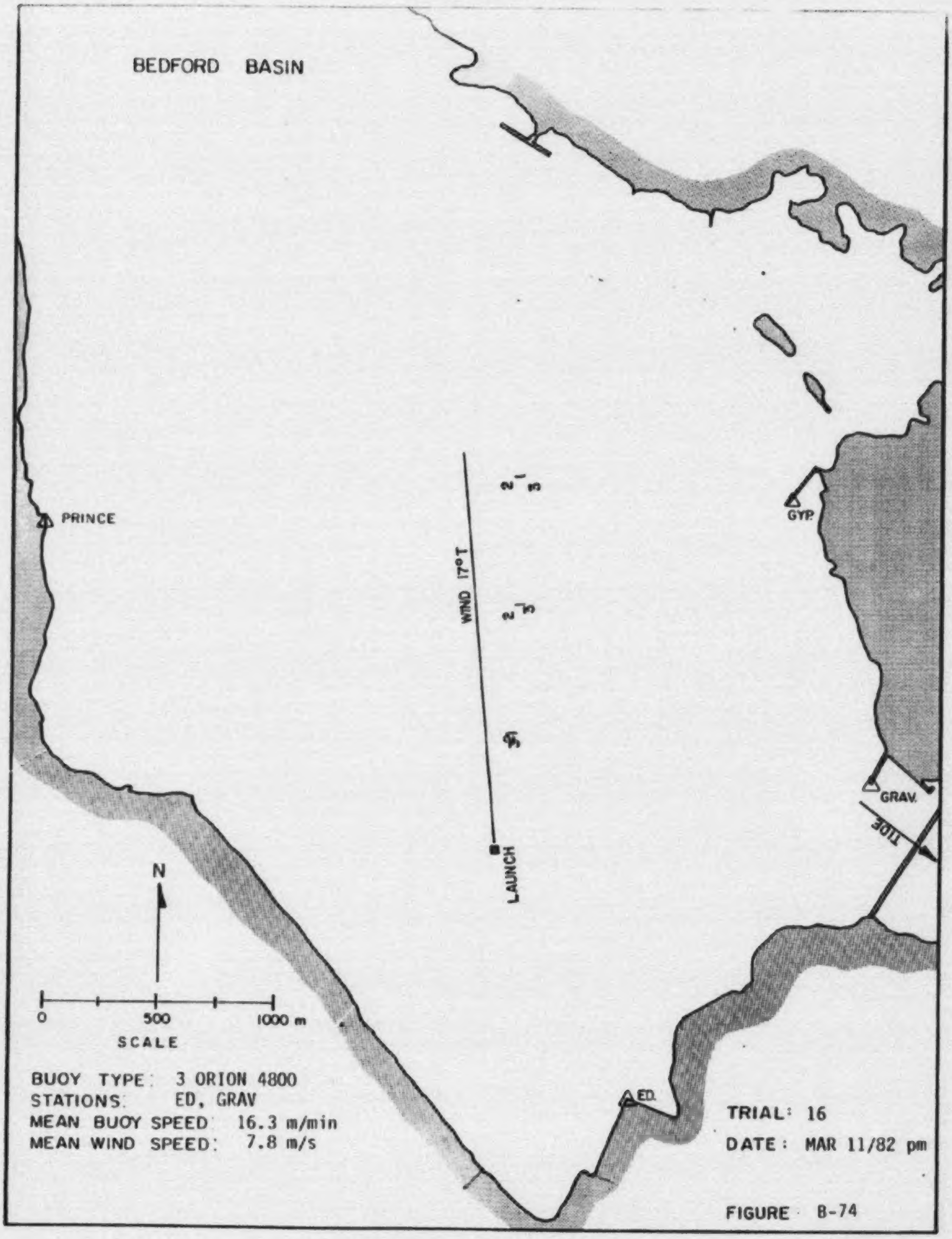

PRINCE
GYP.
GRAV.
TIDE
ED.
LAUNCH
WIND 170° T
2
2
2
N
0
500
1000 m
SCALE

BEDFORD BASIN

BUOY TYPE 2 TAR BALL
STATIONS ED, GRAV
MEAN BUOY SPEED 17.1 m/min
MEAN WIND SPEED 7.8 m/s

TRIAL: 16
DATE: MAR 11/82 pm
1326-1517

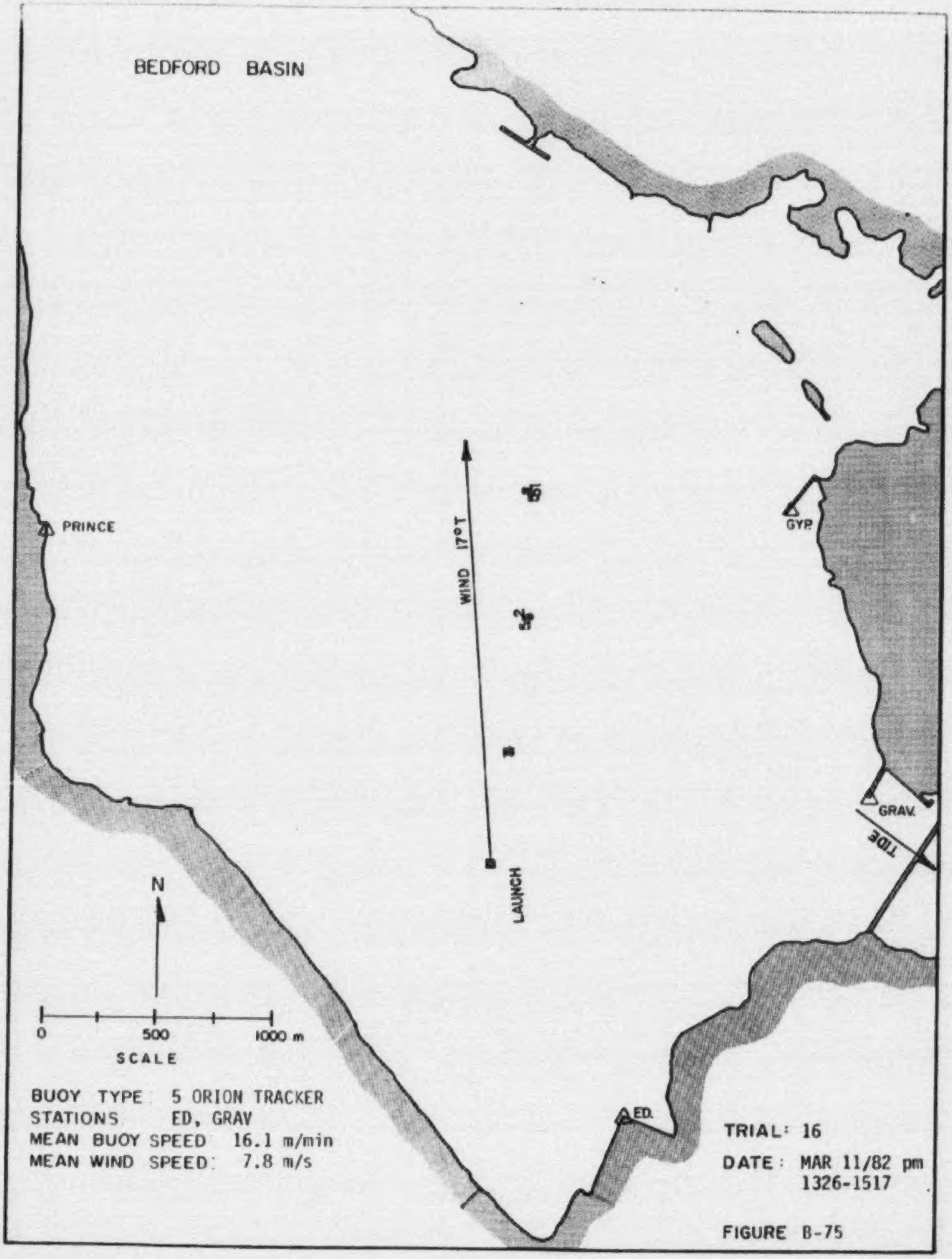
FIGURE B-73


BEDFORD BASIN
PRINCE
GYP.
GRAV.
TIDE
WIND 17°T
LAUNCH
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 3 ORION 4800
STATIONS: ED, GRAV
MEAN BUOY SPEED: 16.3 m/min
MEAN WIND SPEED: 7.8 m/s

TRIAL: 16
DATE: MAR 11/82 pm

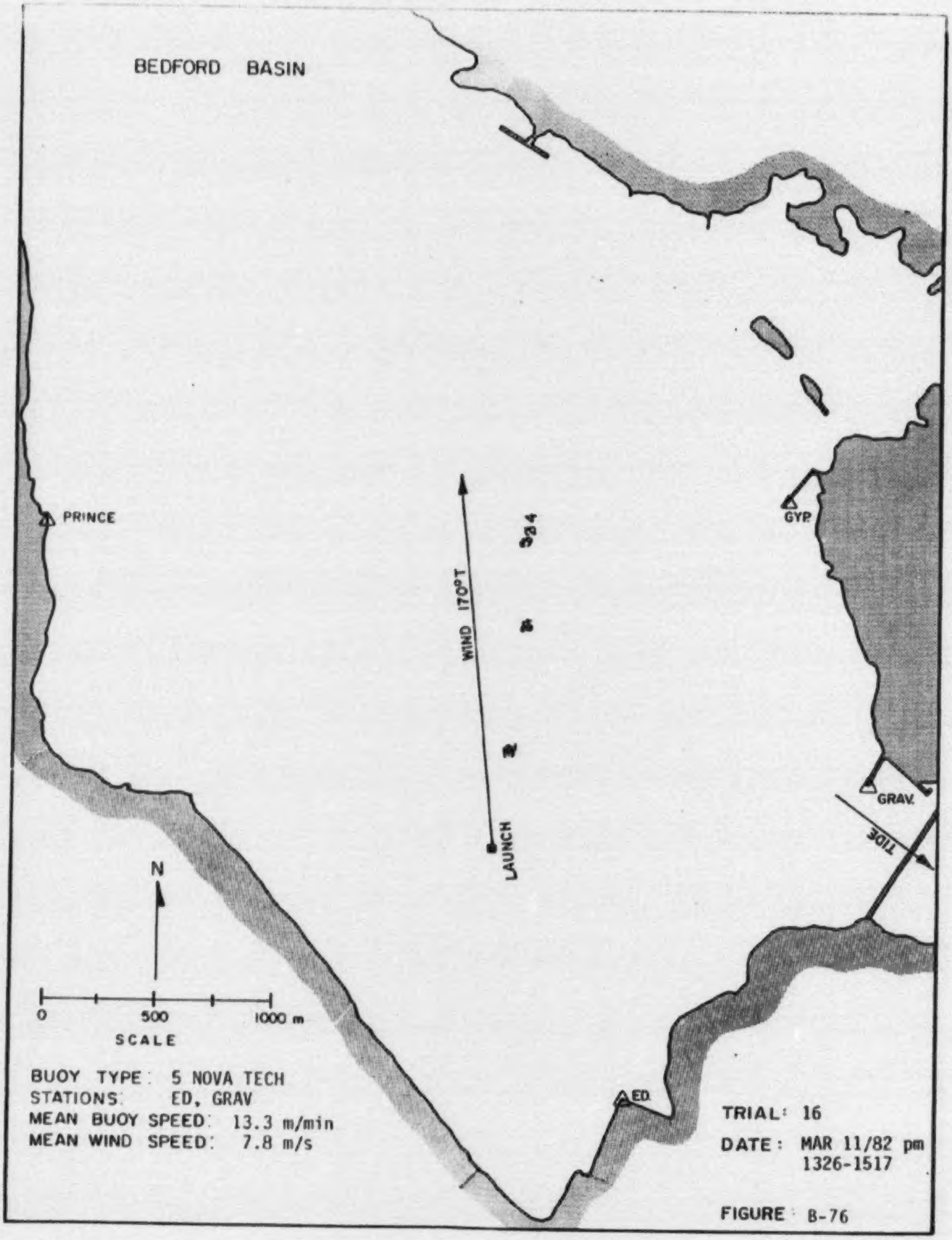
FIGURE B-74


BEDFORD BASIN
PRINCE
GYP.
GRAV.
TIDE
ED.
WIND 17°T
LAUNCH
N
0
500
1000 m
SCALE

BUOY TYPE 5 ORION TRACKER
STATIONS ED, GRAV
MEAN BUOY SPEED 16.1 m/min
MEAN WIND SPEED: 7.8 m/s

TRIAL: 16
DATE: MAR 11/82 pm
1326-1517

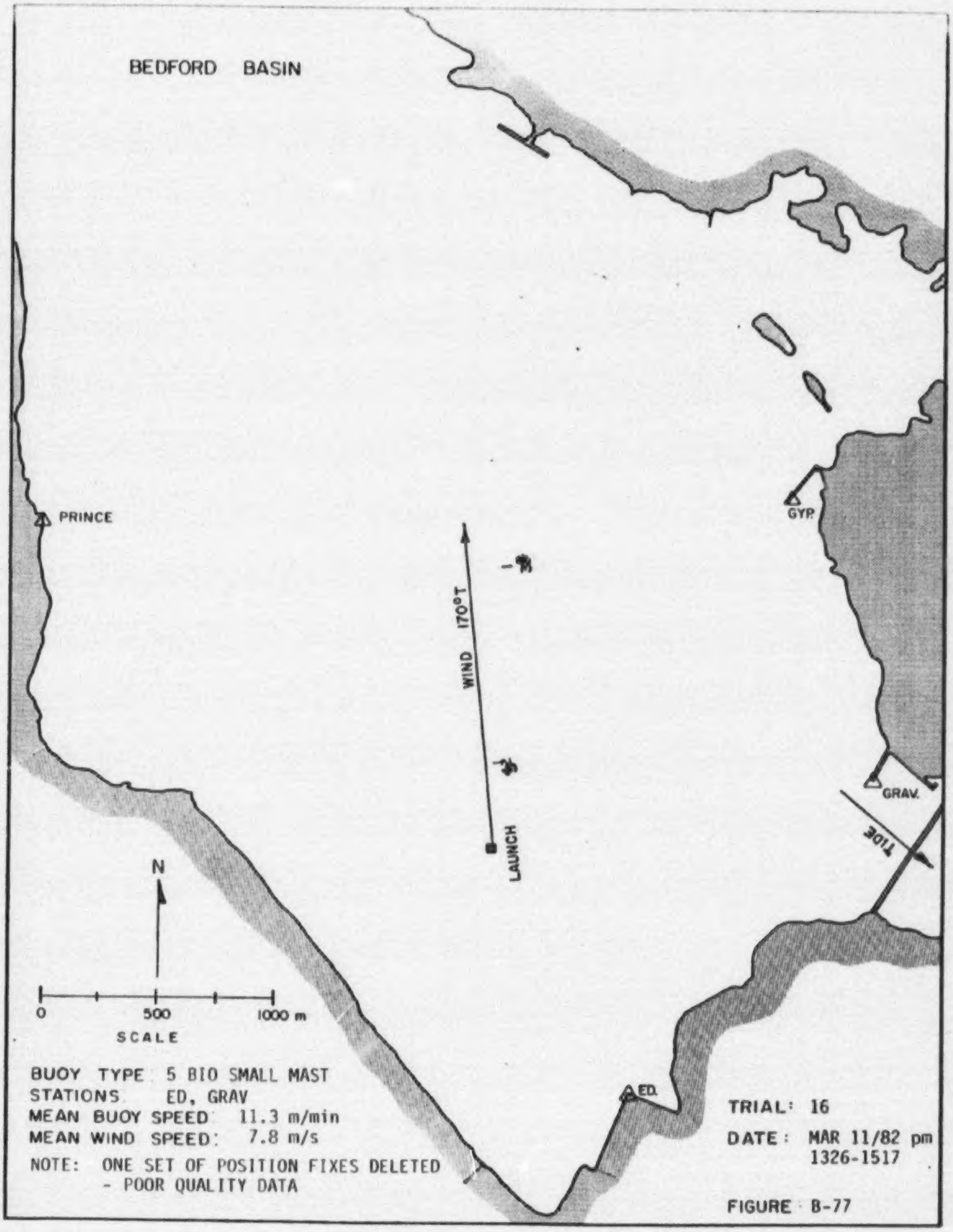
FIGURE B-75


BEDFORD BASIN
PRINCE
GYP.
GRAV.
ED.
WIND 170°T
LAUNCH
TIDE
3 4
2
N
0
500
1000 m
SCALE

BUOY TYPE: 5 NOVA TECH
STATIONS: ED, GRAV
MEAN BUOY SPEED: 13.3 m/min
MEAN WIND SPEED: 7.8 m/s

TRIAL: 16
DATE: MAR 11/82 pm
1326-1517

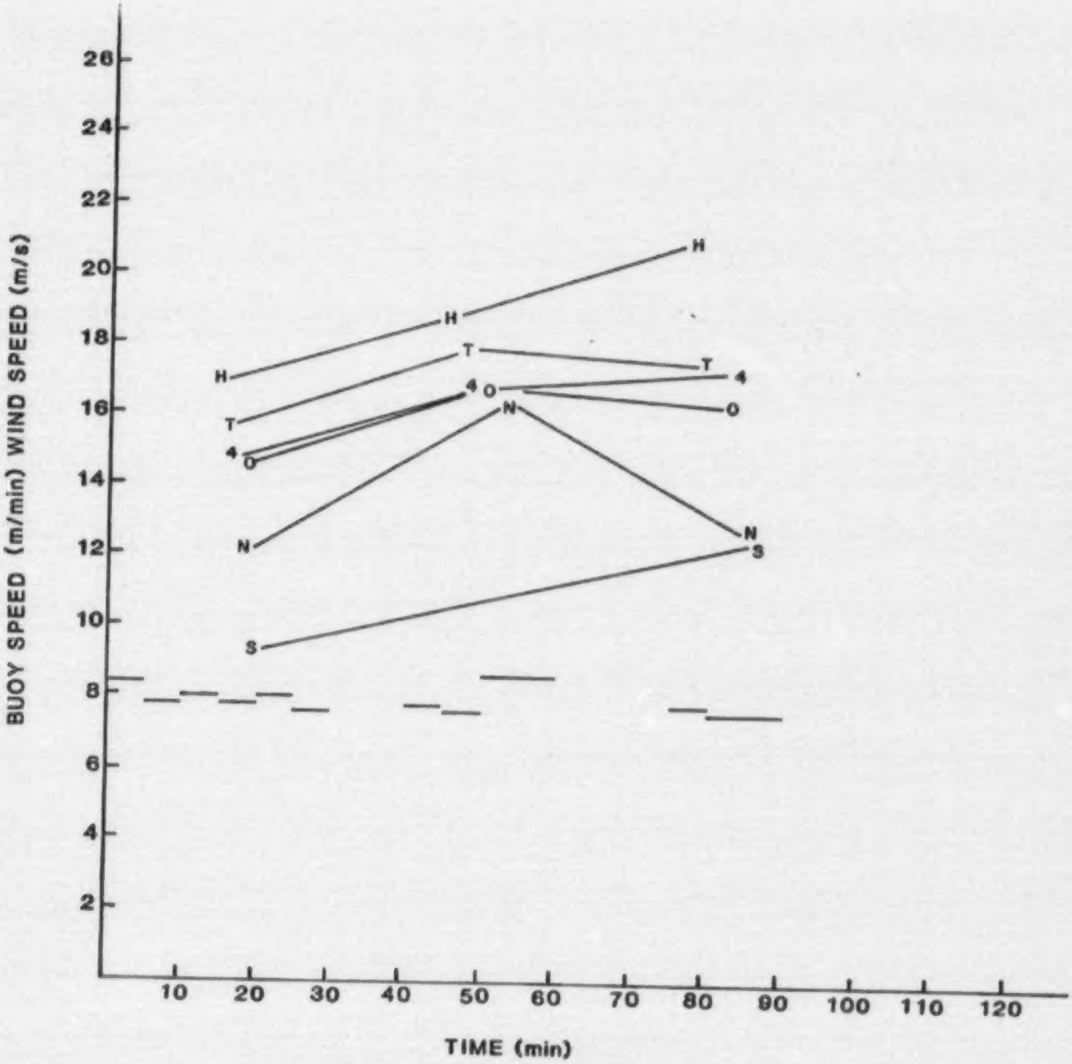
FIGURE B-76


BEDFORD BASIN
PRINCE
GYP.
WIND 170°T
LAUNCH
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO SMALL MAST
STATIONS: ED, GRAV
MEAN BUOY SPEED: 11.3 m/min
MEAN WIND SPEED: 7.8 m/s
NOTE: ONE SET OF POSITION FIXES DELETED - POOR QUALITY DATA

TRIAL: 16
DATE: MAR 11/82 pm 1326-1517

FIGURE B-77



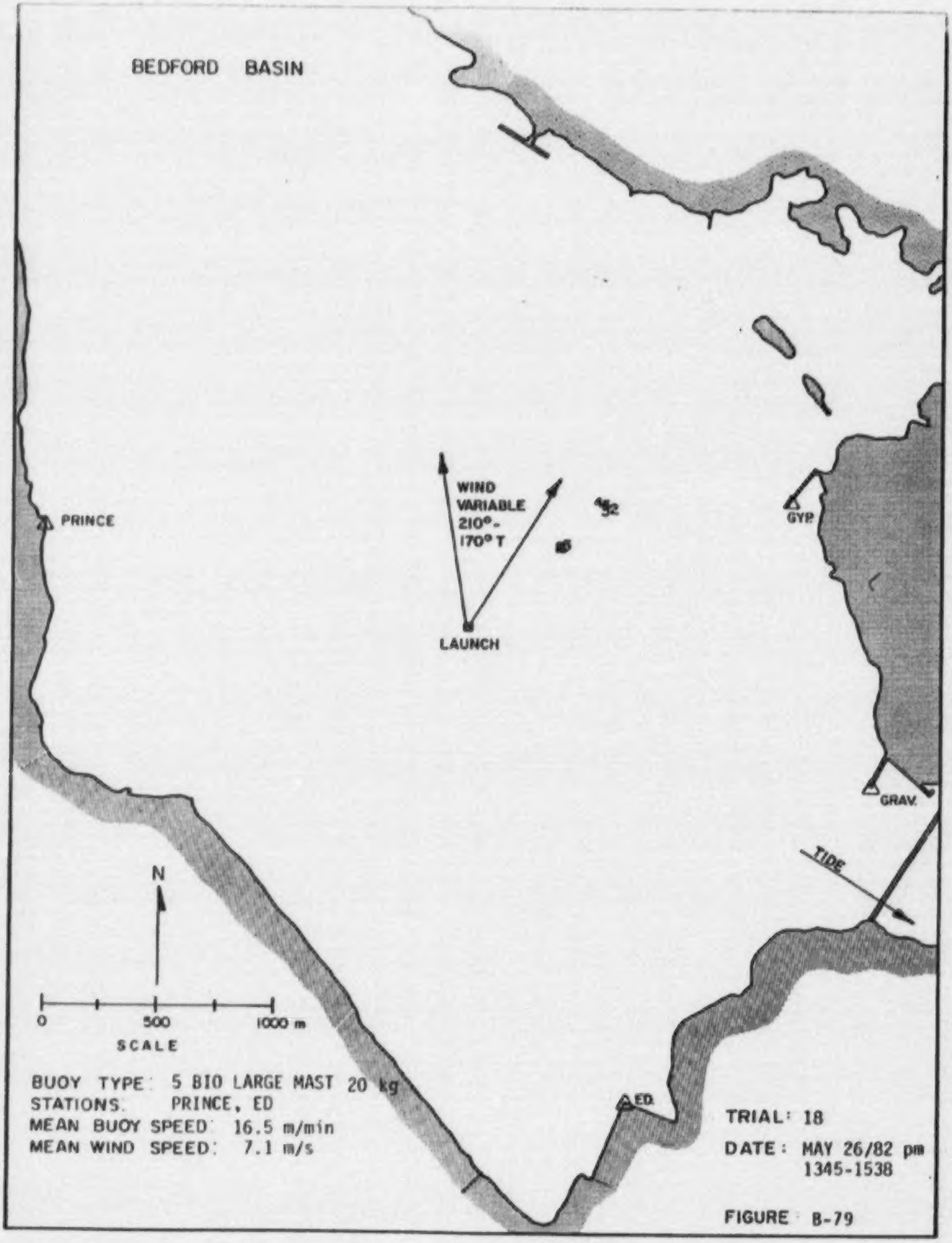
BUOY SPEED (ABSOLUTE, AT

TIME BETWEEN FIXES) Vs TIME (ELAPSED)

LEGEND

H - HERMES
T - TAR BALL
4 - ORION 4800
O - ORION TRACKER
N - NOVA TECH
S - BIO SMALL MAST
— — WIND

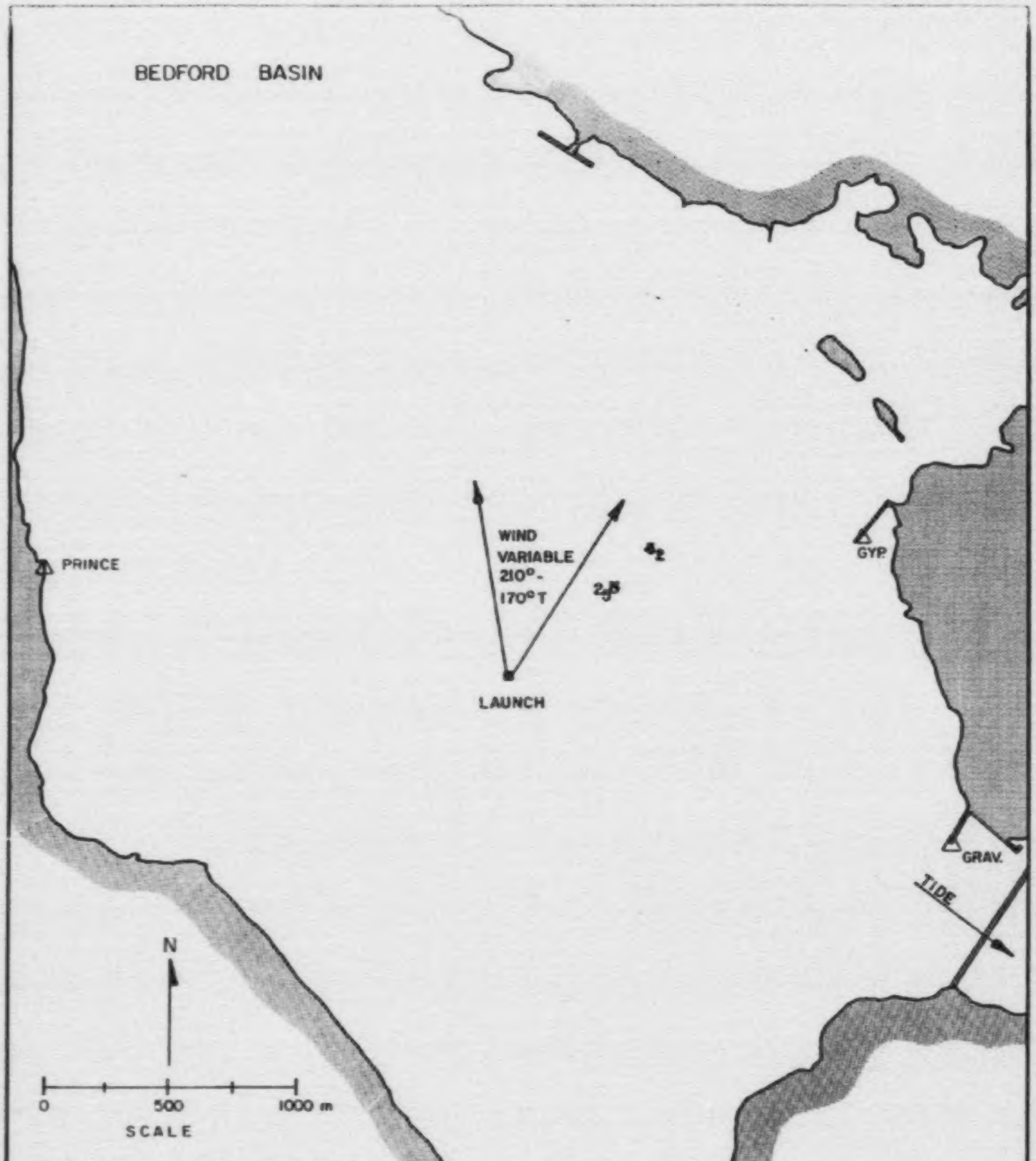
TRIAL : 16
DATE : MAR 11/82, 1326-1517
TIDE : HI - 0905
LOW - 1530
AV. WIND SPEED : 7.8 m/s
FIGURE : B-78


BEDFORD BASIN
PRINCE
WIND
VARIABLE
210°-
170° T
LAUNCH
GYP.
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO LARGE MAST 20 kg
STATIONS: PRINCE, ED
MEAN BUOY SPEED: 16.5 m/min
MEAN WIND SPEED: 7.1 m/s

TRIAL: 18
DATE: MAY 26/82 pm
1345-1538

FIGURE B-79

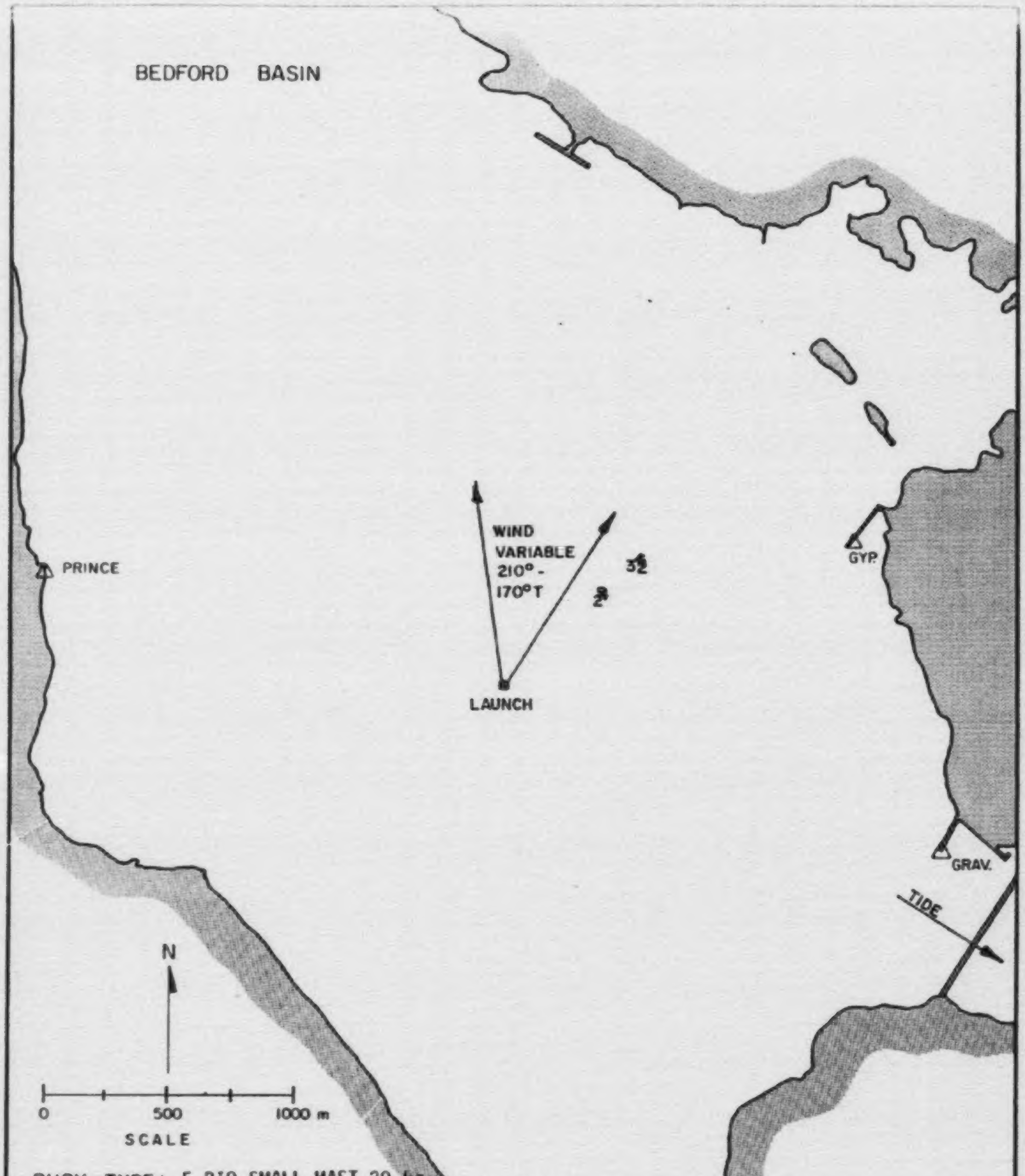

BEDFORD BASIN
PRINCE
GYP.
GRAV.
ED.
TIDE
WIND
VARIABLE
210°-
170°T
4 2
2 3 5
LAUNCH
N
0
500
1000 m
SCALE

BUOY TYPE 5 BIO MED. MAST 20 kg
STATIONS PRINCE, ED
MEAN BUOY SPEED 15.0 m/min
MEAN WIND SPEED: 7.1 m/s

TRIAL: 18

DATE: MAY 26/82 pm
1345-1538

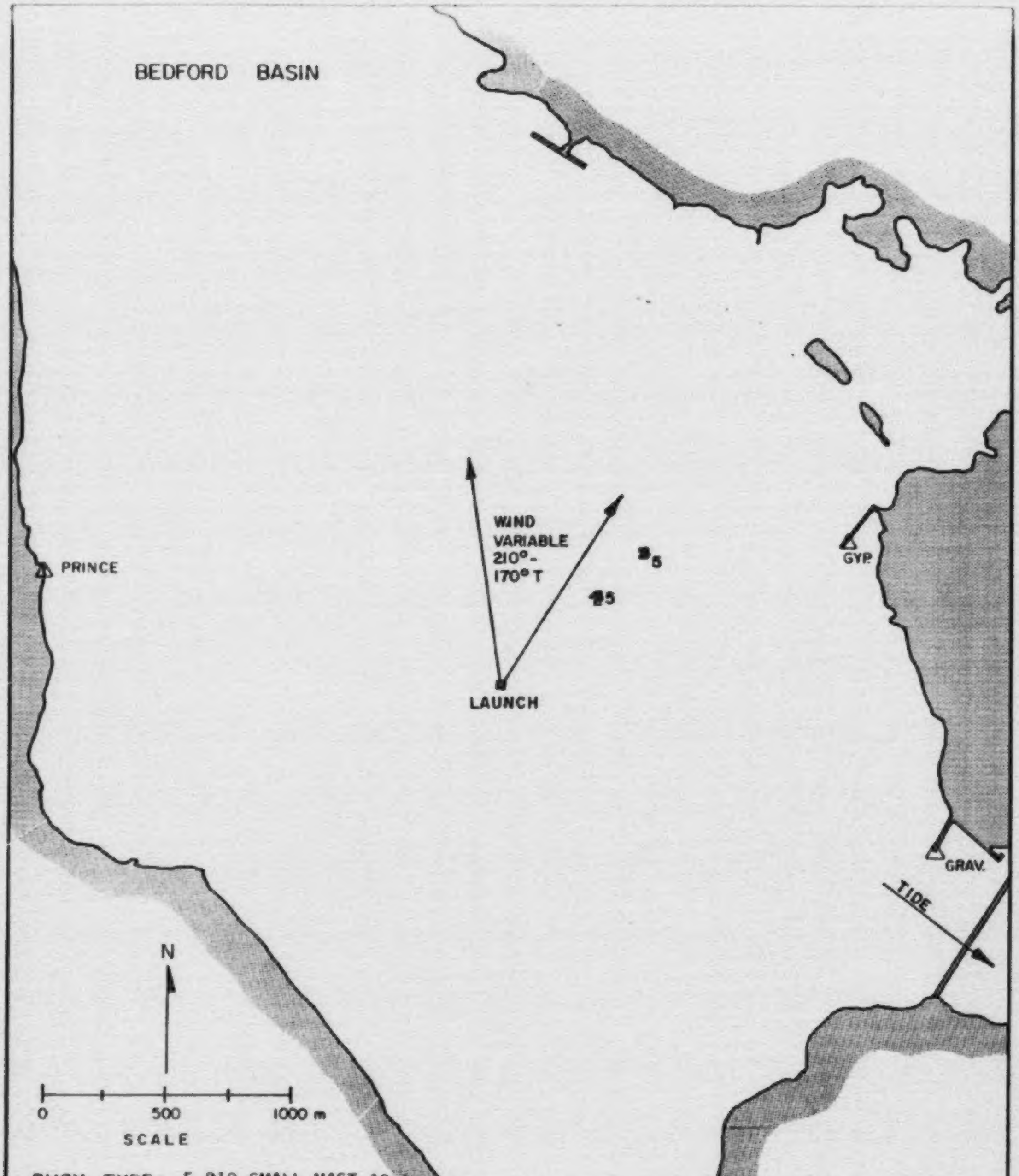
FIGURE B-80


BEDFORD BASIN
PRINCE
WIND
VARIABLE
210° -
170°T
32
2
LAUNCH
GYP.
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO SMALL MAST 20 kg
STATIONS: PRINCE, GRAV
MEAN BUOY SPEED: 13.2 m/min
MEAN WIND SPEED: 7.1 m/s

TRIAL: 18
DATE: MAY 26/82 pm
1345-1538

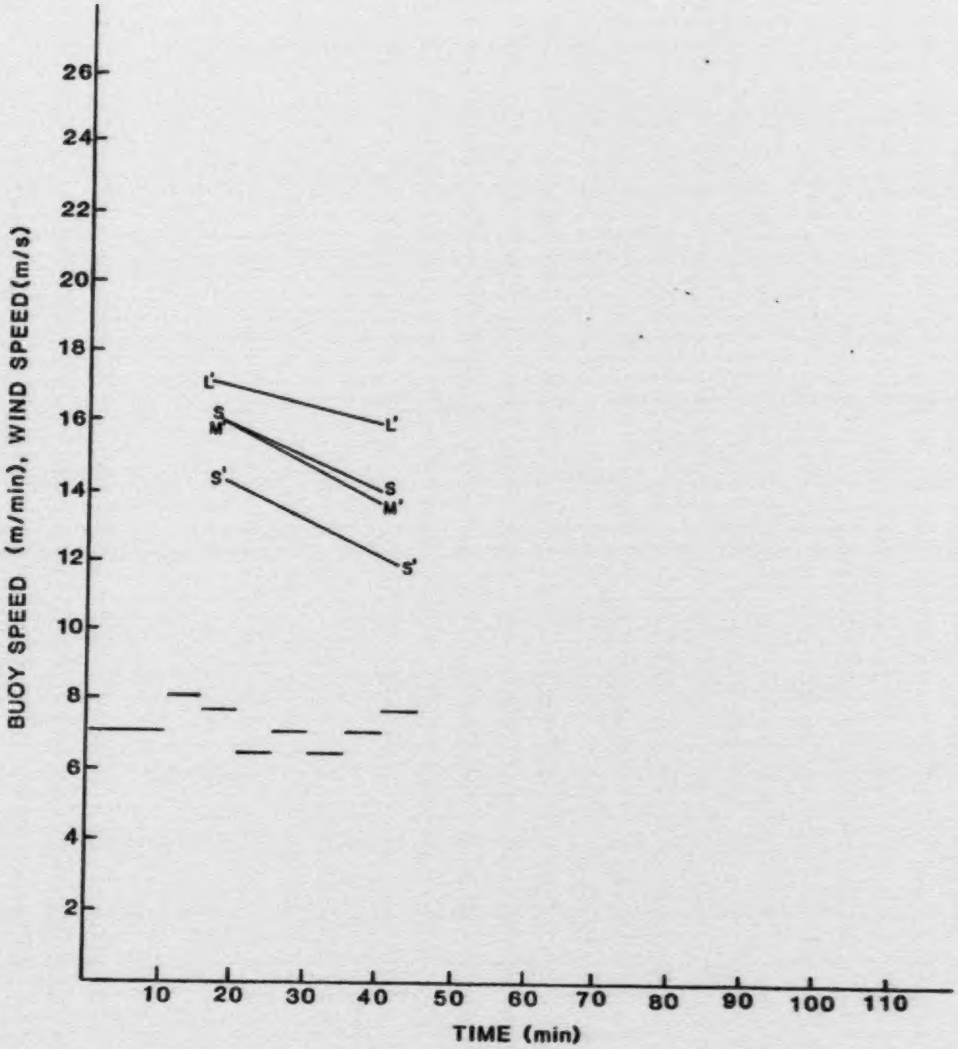
FIGURE B-81


BEDFORD BASIN
WIND
VARIABLE
210°-
170° T
5
5
LAUNCH
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE 5 BIO SMALL MAST 10 kg
STATIONS PRINCE, ED
MEAN BUOY SPEED 15.0 m/min
MEAN WIND SPEED 7.1 m/s

TRIAL: 18
DATE: MAY 26/82 pm
1345-1538

FIGURE B-82

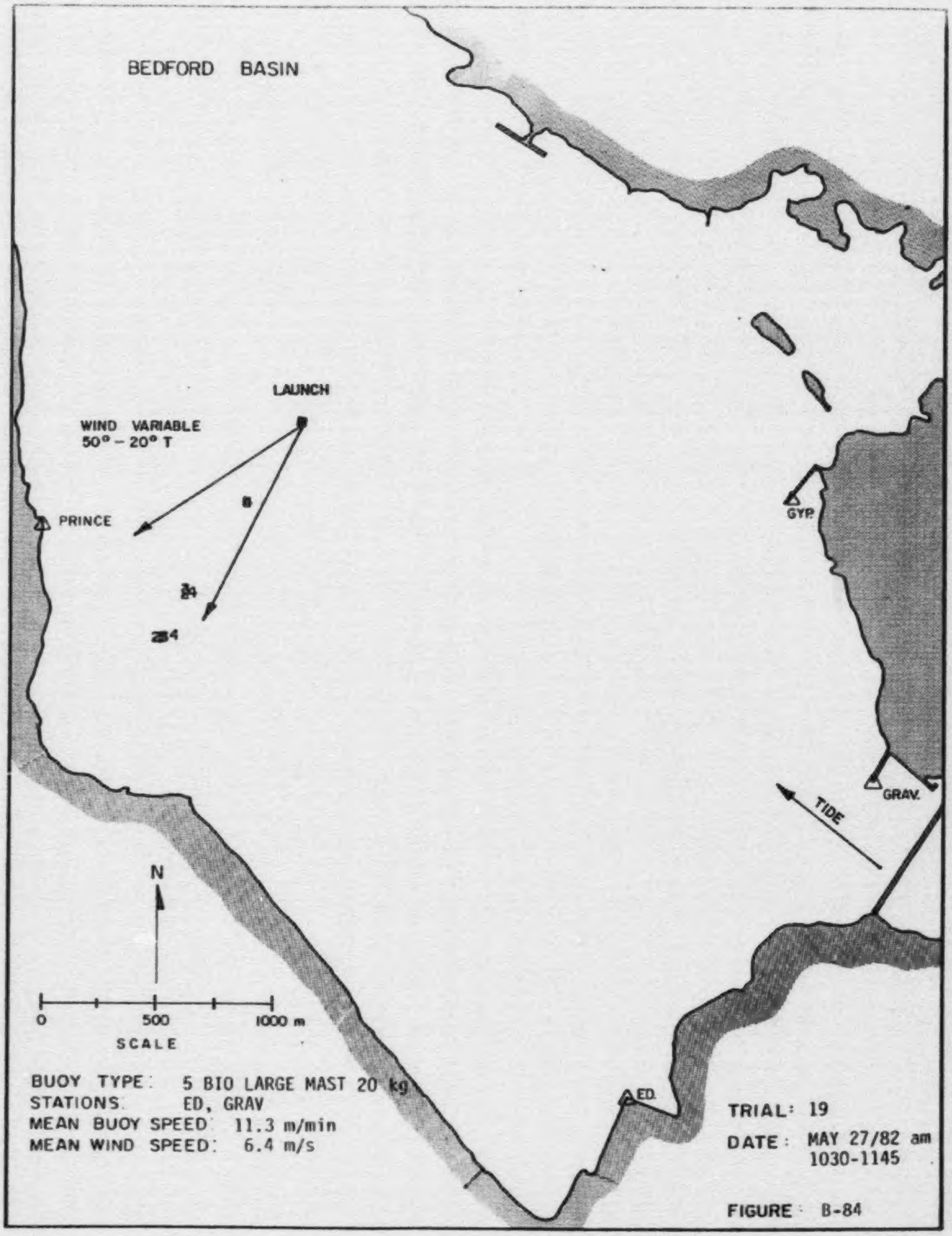


BUOY SPEED (ABSOLUTE ,AT
TIME BETWEEN FIXES). Vs TIME (ELAPSED)

LEGEND

L' - BIO LARGE MAST 20 kg
M' - BIO MED. MAST 20 kg
S' - BIO SMALL MAST 20 kg
S - BIO SMALL MAST 10 kg
— — WIND

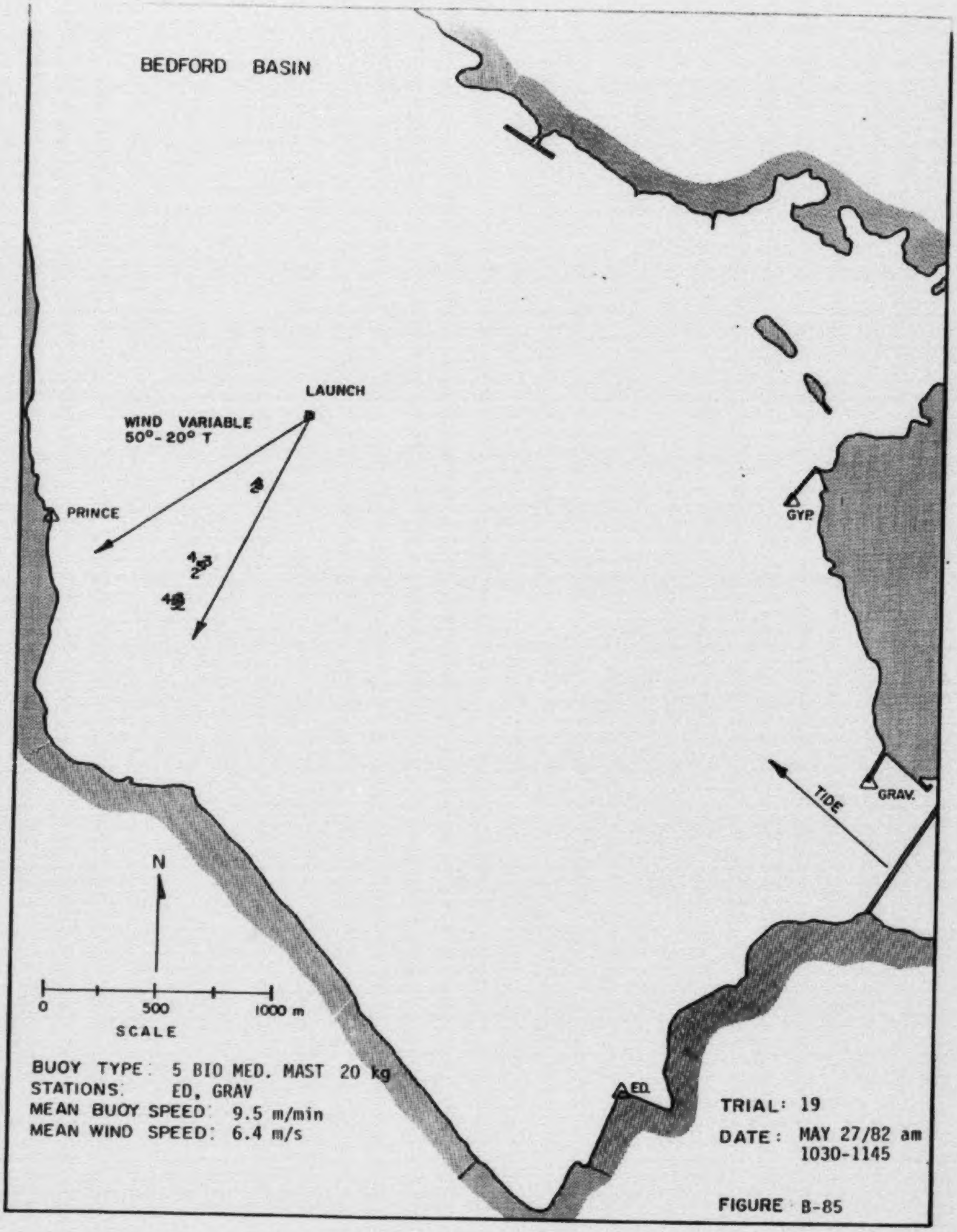
TRIAL : 18
DATE : MAY 26/82, 1345-1538
TIDE : HI - 1030
LOW - 1705
AV. WIND SPEED : 7.1 m/s
FIGURE : B-83


BEDFORD BASIN
LAUNCH
WIND VARIABLE
50° - 20° T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO LARGE MAST 20 kg
STATIONS: ED, GRAV
MEAN BUOY SPEED: 11.3 m/min
MEAN WIND SPEED: 6.4 m/s

TRIAL: 19
DATE: MAY 27/82 am
1030-1145

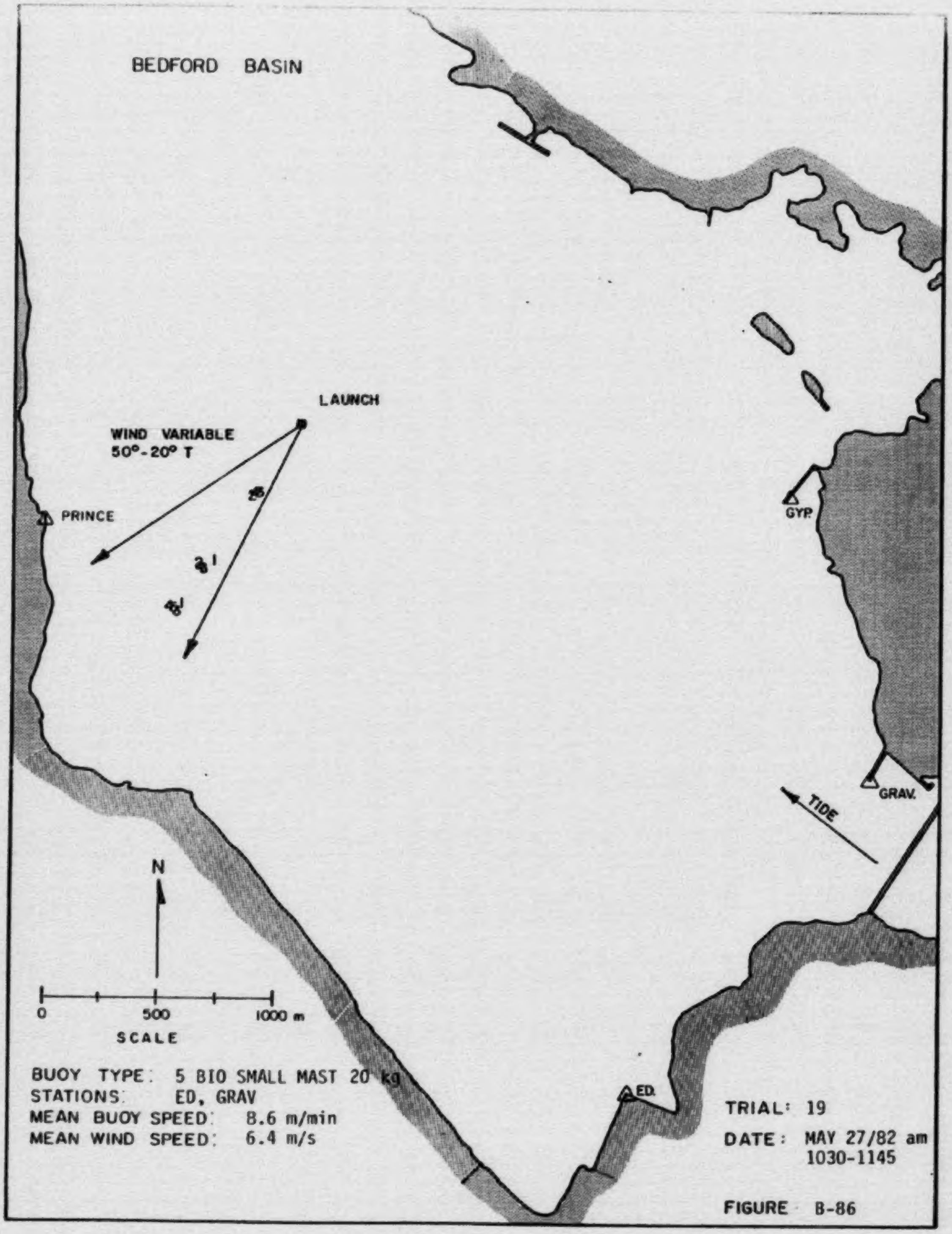
FIGURE B-84


BEDFORD BASIN
LAUNCH
WIND VARIABLE
50°- 20° T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO MED. MAST 20 kg
STATIONS: ED, GRAV
MEAN BUOY SPEED: 9.5 m/min
MEAN WIND SPEED: 6.4 m/s

TRIAL: 19
DATE: MAY 27/82 am
1030-1145

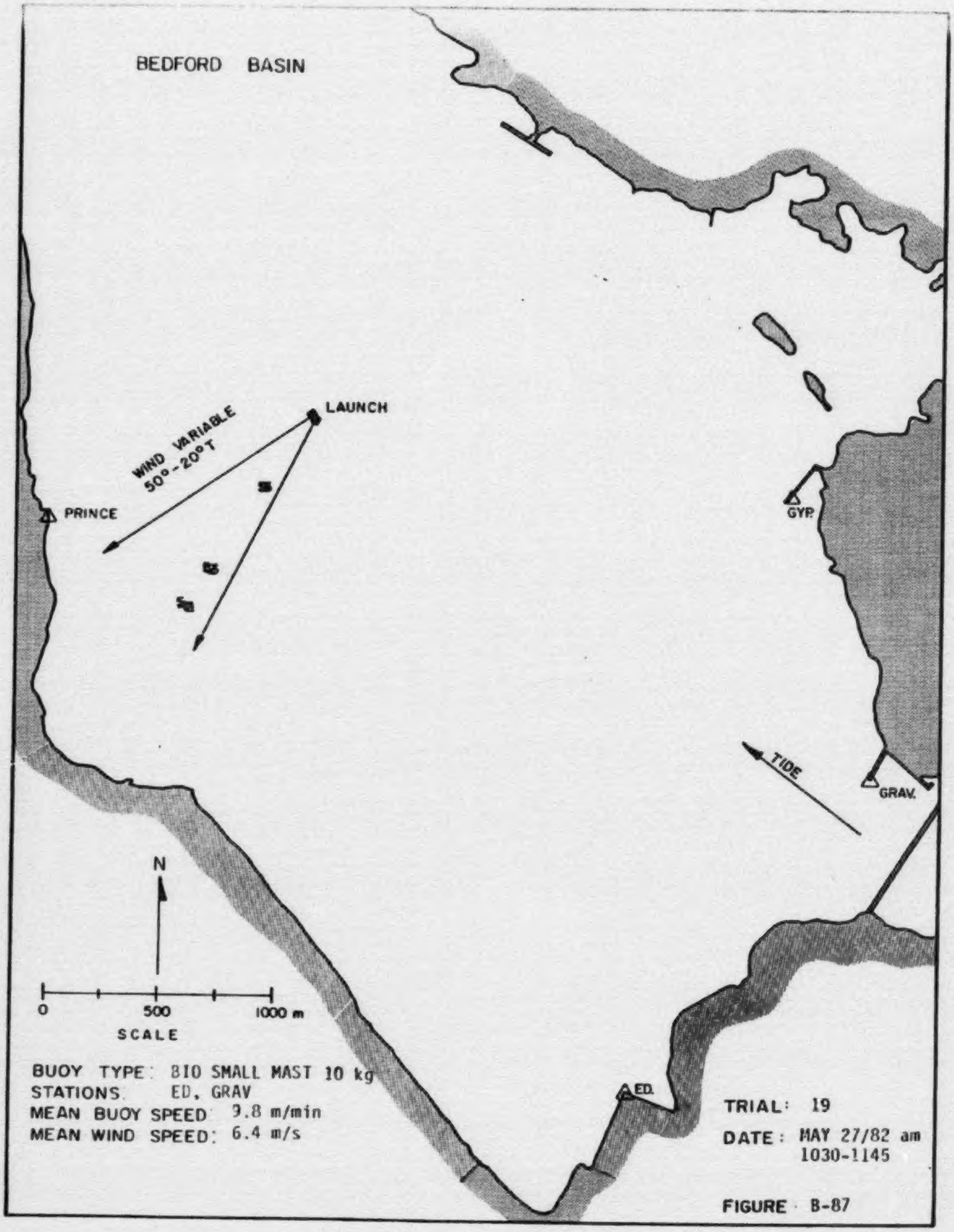
FIGURE B-85


BEDFORD BASIN
LAUNCH
WIND VARIABLE
50°-20° T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO SMALL MAST 20 kg
STATIONS: ED, GRAV
MEAN BUOY SPEED: 8.6 m/min
MEAN WIND SPEED: 6.4 m/s

TRIAL: 19
DATE: MAY 27/82 am
1030-1145

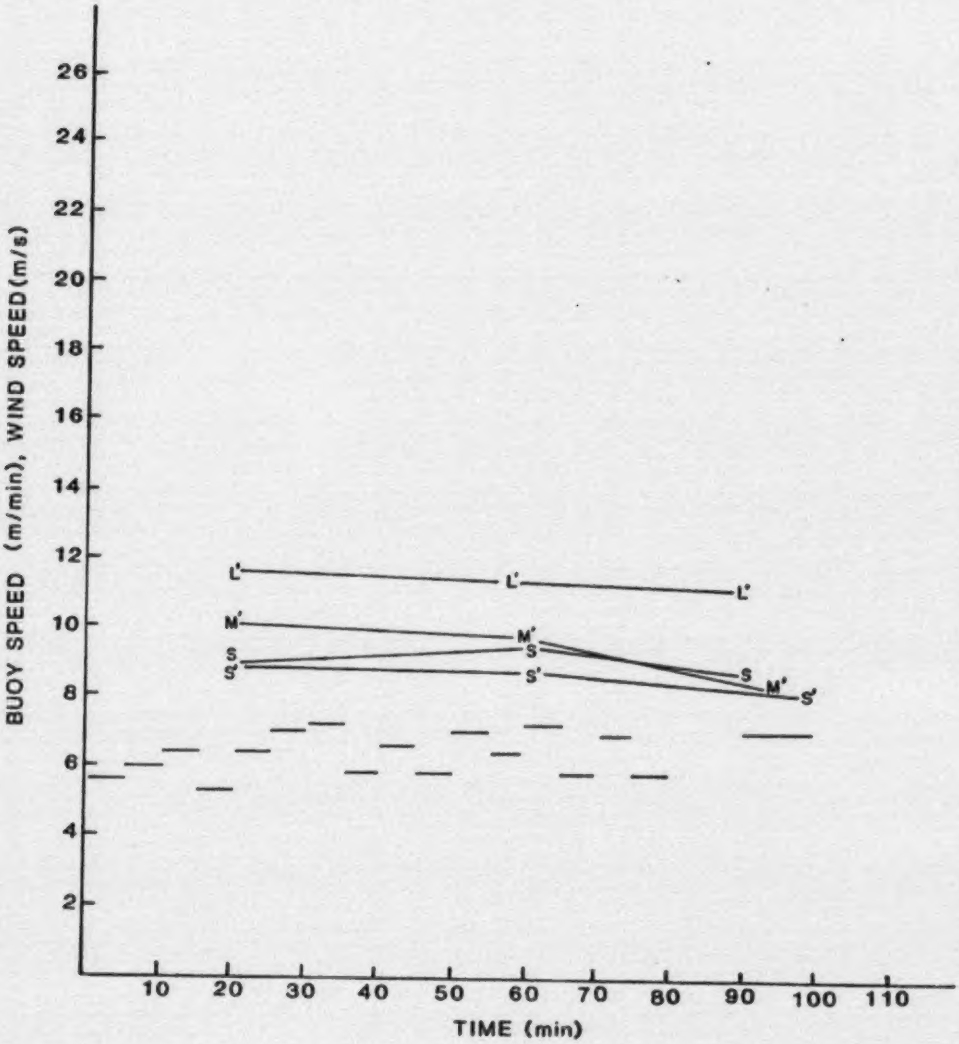
FIGURE B-86


BEDFORD BASIN
LAUNCH
WIND VARIABLE 50°-20°T
PRINCE
GYP.
TIDE
GRAV.
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: BIO SMALL MAST 10 kg
STATIONS: ED, GRAV
MEAN BUOY SPEED: 9.8 m/min
MEAN WIND SPEED: 6.4 m/s

TRIAL: 19
DATE: MAY 27/82 am
1030-1145

FIGURE B-87



BUOY SPEED (ABSOLUTE ,AT
TIME BETWEEN FIXES). Vs TIME (ELAPSED)

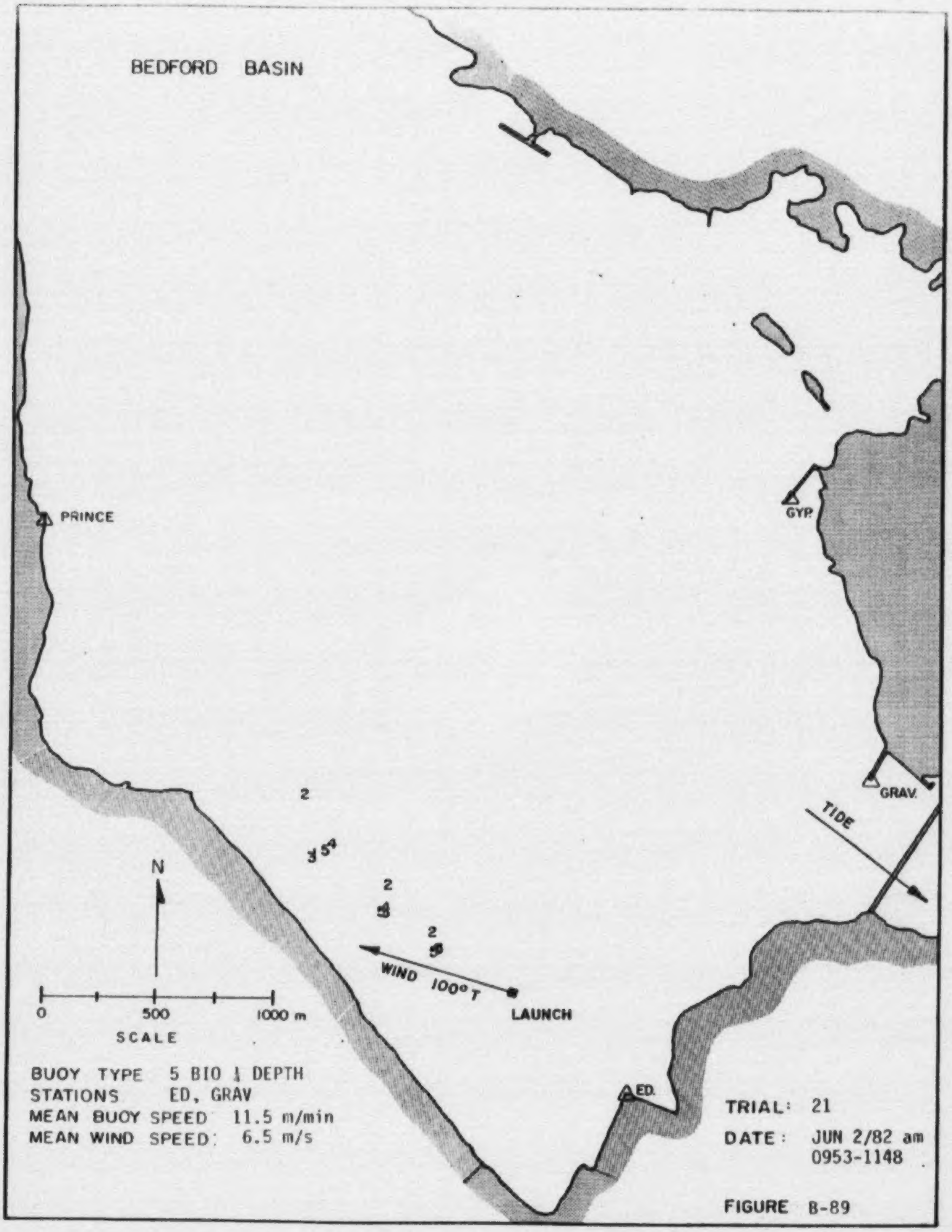
LEGEND

L' - BIO LARGE MAST 20 kg
M' - BIO MED. MAST 20 kg
S' - BIO SMALL MAST 20 kg
S - BIO SMALL MAST 10 kg
— — WIND

TRIAL : 19
DATE : MAY 27/82, 1030-1145
TIDE : LOW - 0540
HI-1115

AV. WIND SPEED : 6.4 m/s

FIGURE : B-88


BEDFORD BASIN
PRINCE
GYP.
GRAV.
TIDE
N
0
500
1000 m
SCALE
WIND 100° T
LAUNCH
ED.
2
3 5 4
2
5
2
5

BUOY TYPE 5 BIO ¼ DEPTH
STATIONS ED, GRAV
MEAN BUOY SPEED 11.5 m/min
MEAN WIND SPEED: 6.5 m/s

TRIAL: 21
DATE: JUN 2/82 am
0953-1148

FIGURE B-89

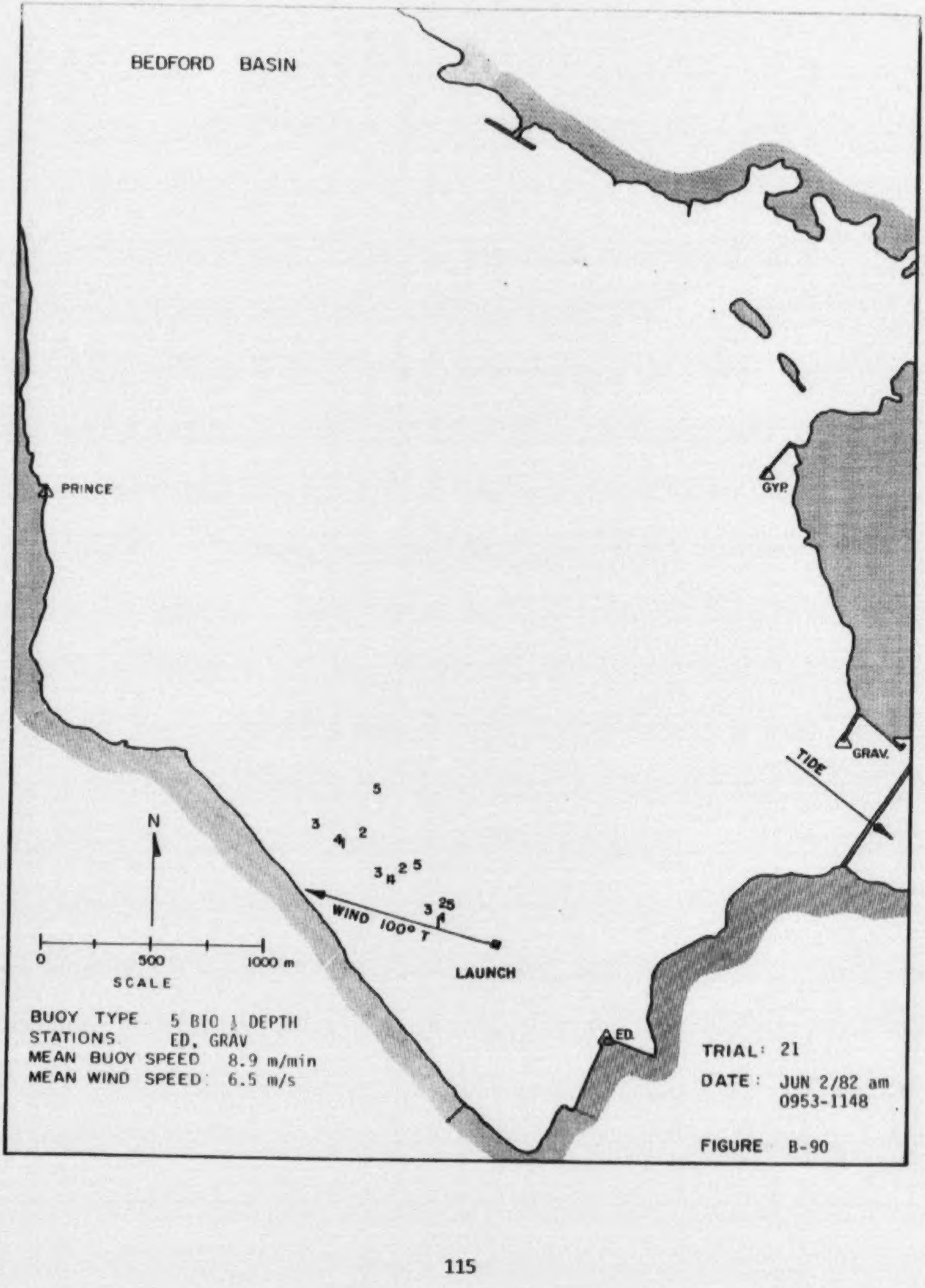
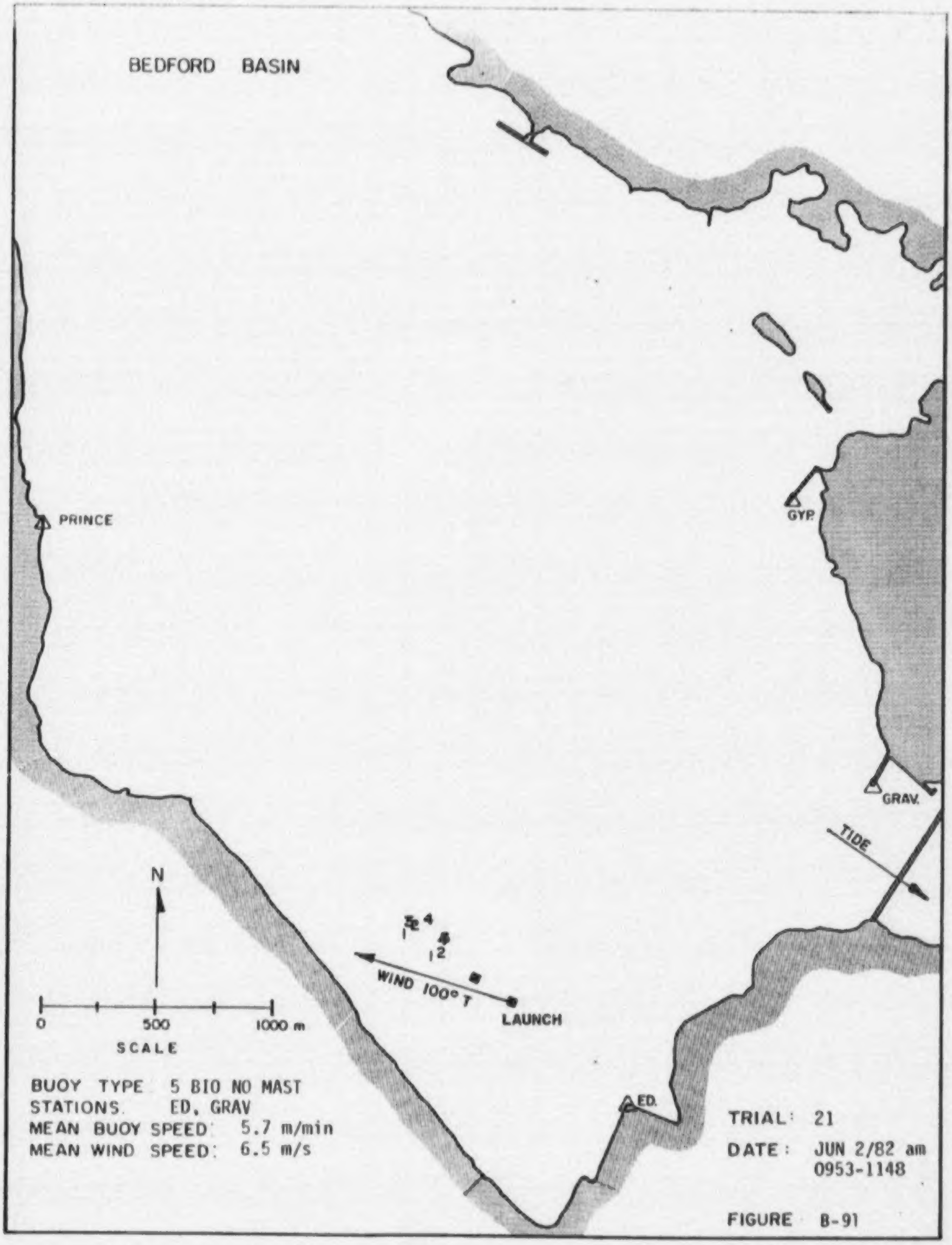

BEDFORD BASIN
PRINCE
GYP.
GRAV.
TIDE
5
3
4
2
3
4
2
5
3
25
4
N
WIND 100° T
LAUNCH
0
500
1000 m
SCALE
ED.
BUOY TYPE 5 BIO ½ DEPTH
STATIONS ED, GRAV
MEAN BUOY SPEED 8.9 m/min
MEAN WIND SPEED 6.5 m/s
TRIAL: 21
DATE: JUN 2/82 am
0953-1148

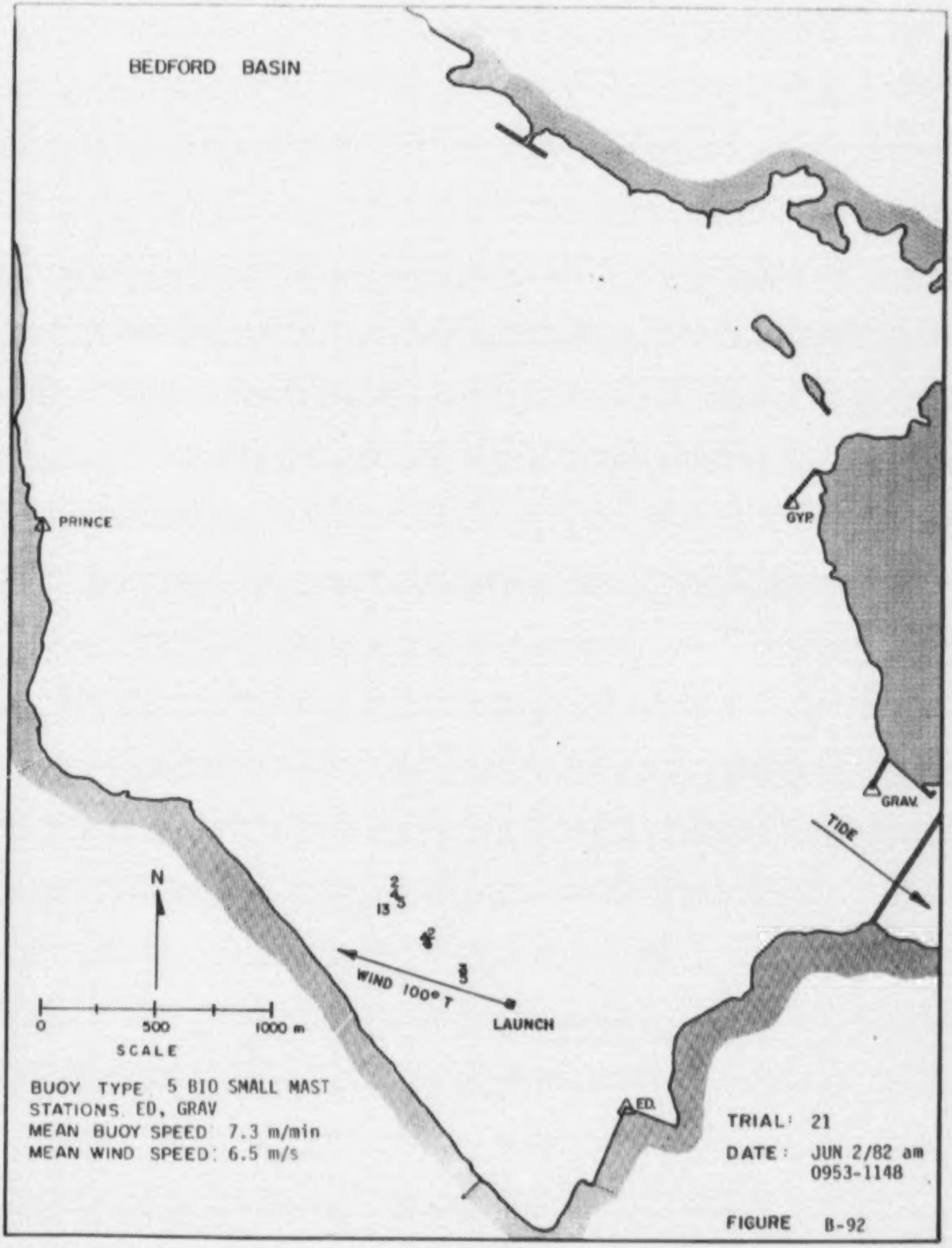
FIGURE B-90


BEDFORD BASIN
PRINCE
GYP.
GRAV.
TIDE
N
WIND 100° T
LAUNCH
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO NO MAST
STATIONS: ED, GRAV
MEAN BUOY SPEED: 5.7 m/min
MEAN WIND SPEED: 6.5 m/s

TRIAL: 21
DATE: JUN 2/82 am
0953-1148

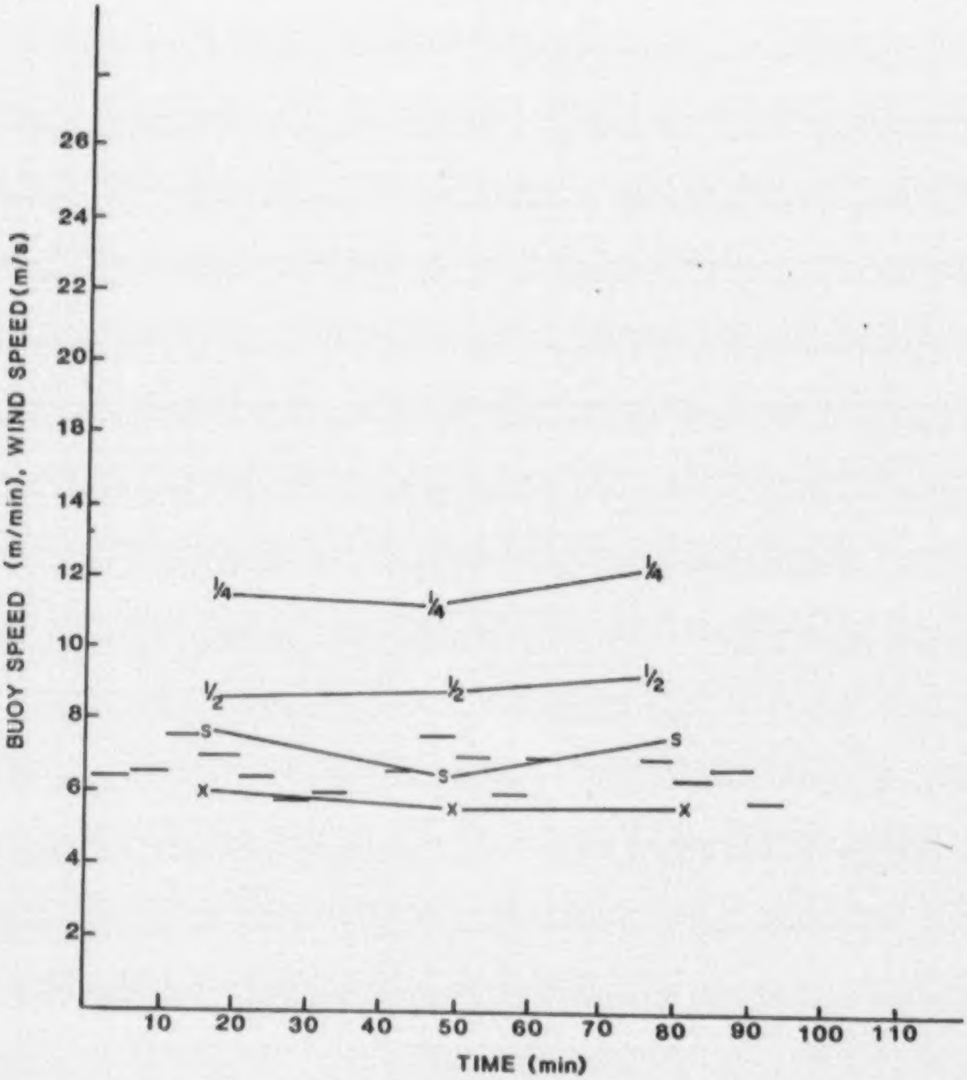
FIGURE B-91


BEDFORD BASIN
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE
2
4
13
5
2
4
5
2
5
WIND 100° T
LAUNCH

BUOY TYPE 5 BIO SMALL MAST
STATIONS ED, GRAV
MEAN BUOY SPEED 7.3 m/min
MEAN WIND SPEED: 6.5 m/s

TRIAL: 21
DATE: JUN 2/82 am
0953-1148

FIGURE B-92

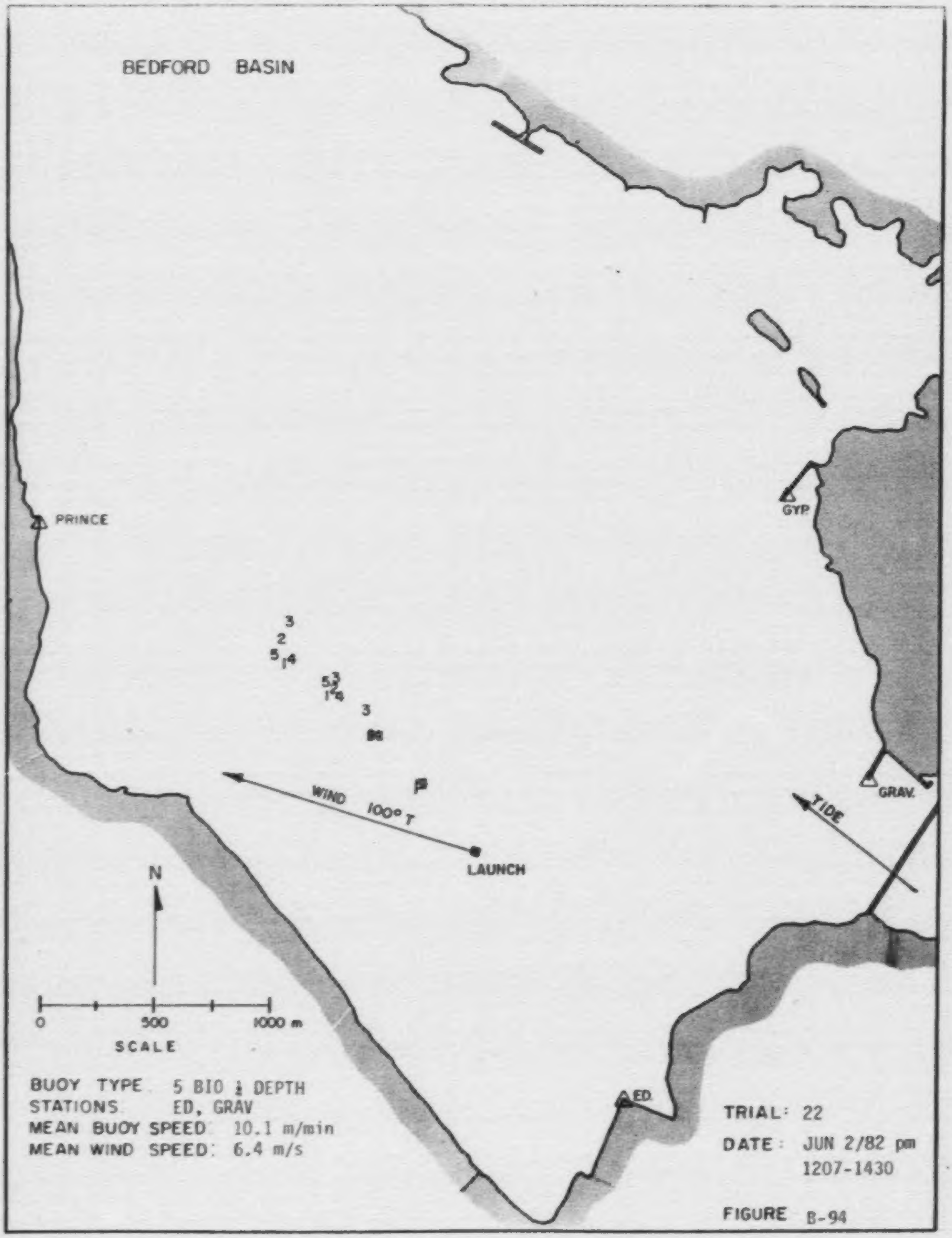


BUOY SPEED (ABSOLUTE ,AT TIME BETWEEN FIXES). Vs TIME (ELAPSED)

LEGEND

¼ - BIO QUARTER DEPTH
½ - BIO HALF DEPTH
S - BIO SMALL MAST
X - BIO NO MAST
— — WIND

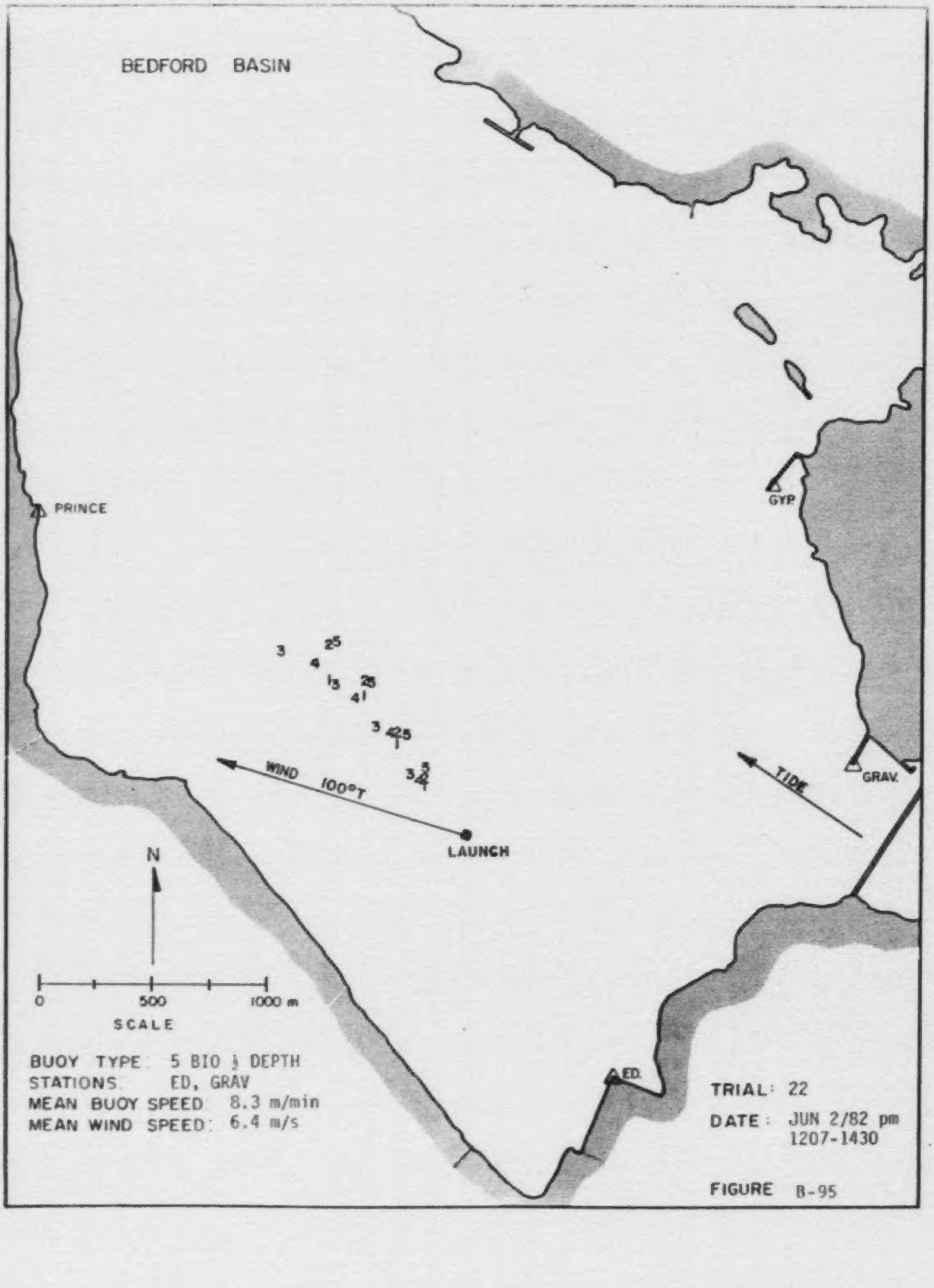
TRIAL : 21
DATE : JUN 2/82, 0953-1148
TIDE : HI - 0455
LOW - 1120
AV. WIND SPEED : 6.5 m/s
FIGURE : B-93


BEDFORD BASIN
PRINCE
GYP
GRAV.
ED.
TIDE
WIND 100° T
LAUNCH
3
2
5
1
4
5
3
2
1
4
3
N
0
500
1000 m
SCALE

BUOY TYPE 5 BIO ½ DEPTH
STATIONS ED, GRAV
MEAN BUOY SPEED 10.1 m/min
MEAN WIND SPEED: 6.4 m/s

TRIAL: 22
DATE: JUN 2/82 pm
1207-1430

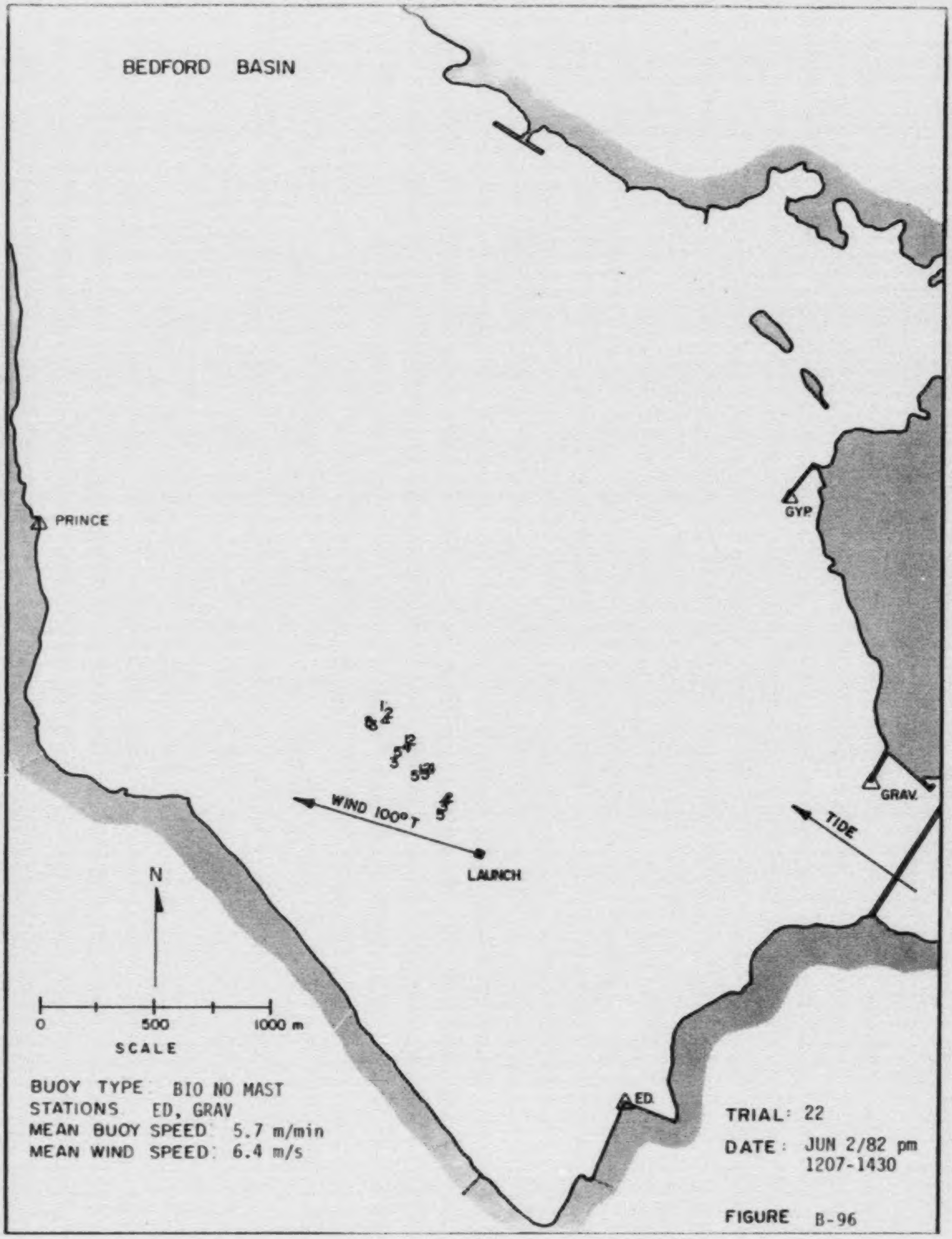
FIGURE B-94


BEDFORD BASIN
PRINCE
GYP.
GRAV.
ED.
WIND 100°T
TIDE
LAUNCH
N
0
500
1000 m
SCALE
3
25
4
15
25
41
3
425
1
5
3
2
4

BUOY TYPE: 5 BIO ½ DEPTH
STATIONS: ED, GRAV
MEAN BUOY SPEED: 8.3 m/min
MEAN WIND SPEED: 6.4 m/s

TRIAL: 22
DATE: JUN 2/82 pm
1207-1430

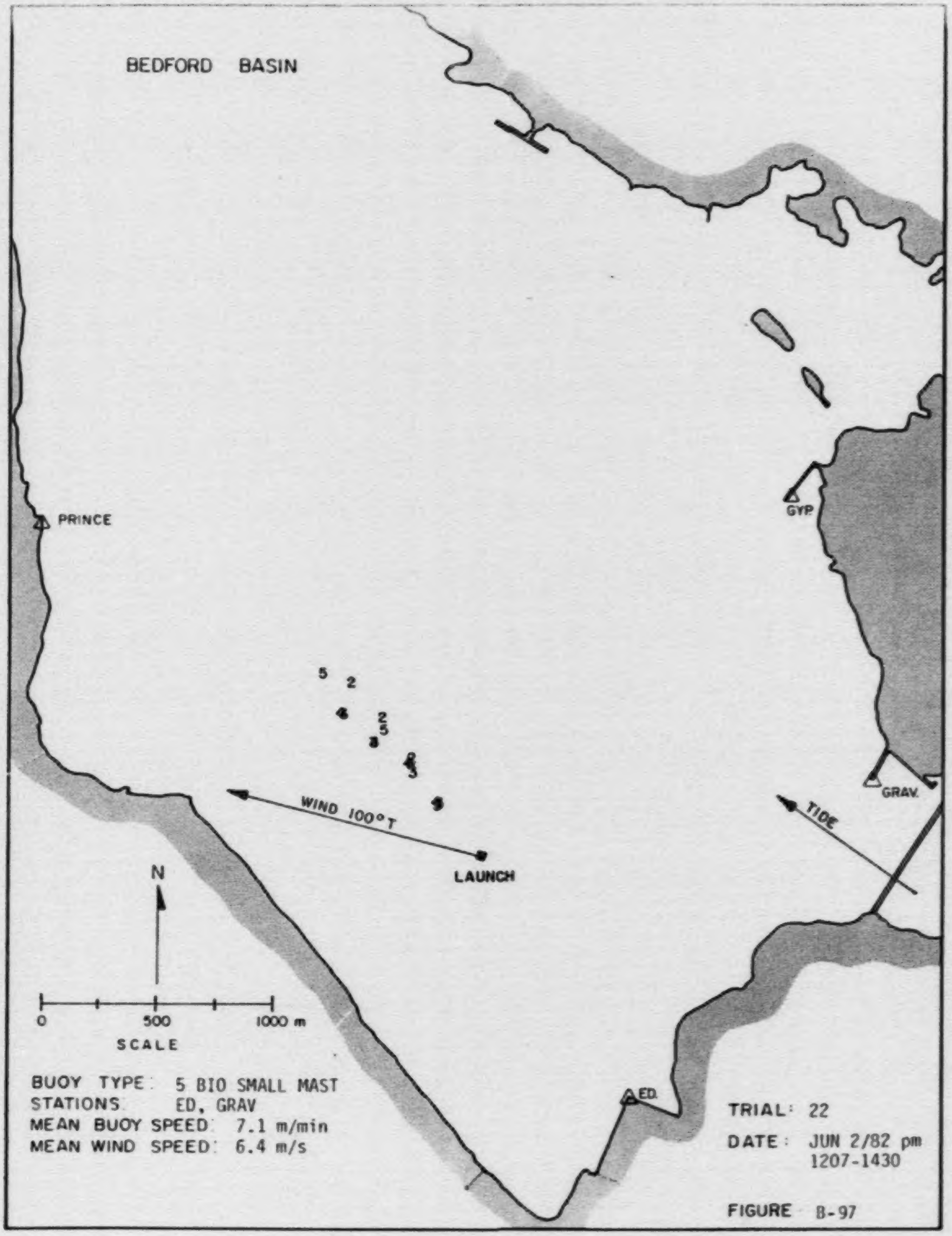
FIGURE B-95


BEDFORD BASIN
PRINCE
GYP.
GRAV.
ED.
TIDE
WIND 100° T
LAUNCH
N
0
500
1000 m
SCALE

BUOY TYPE: BIO NO MAST
STATIONS: ED, GRAV
MEAN BUOY SPEED: 5.7 m/min
MEAN WIND SPEED: 6.4 m/s

TRIAL: 22
DATE: JUN 2/82 pm
1207-1430

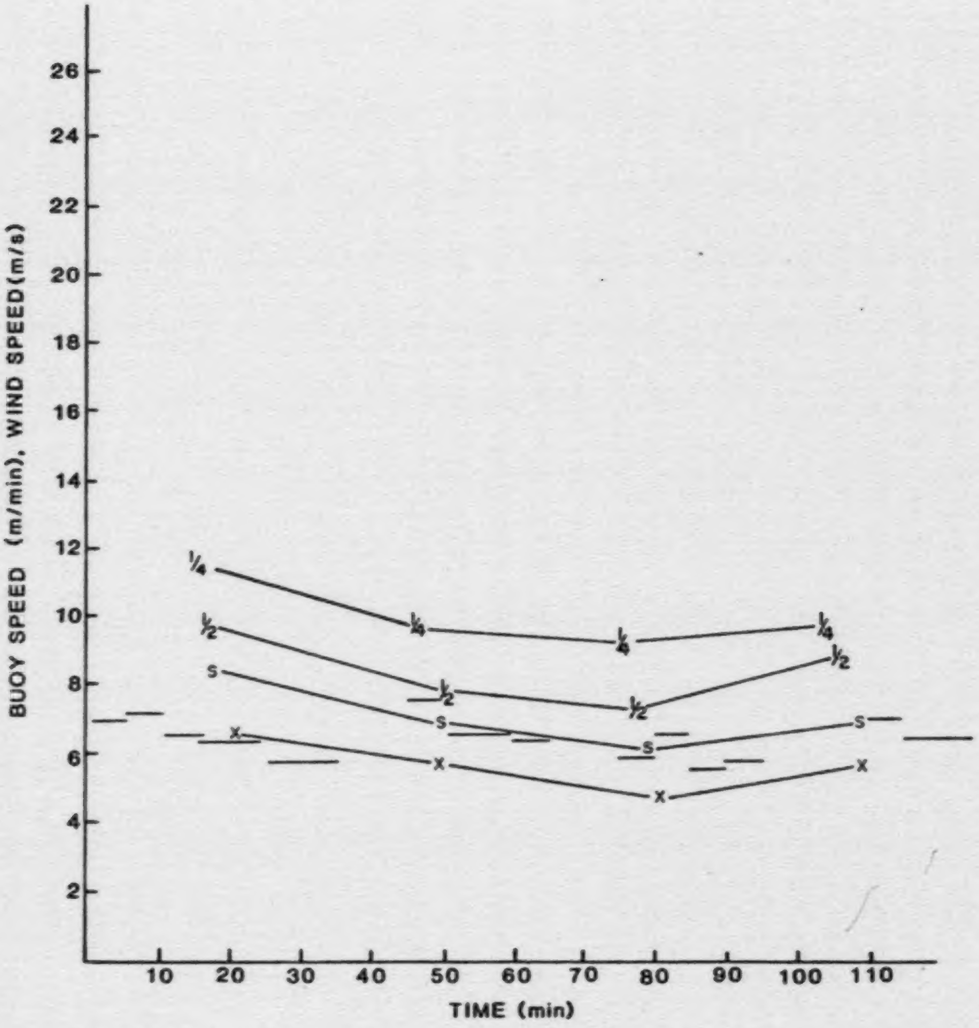
FIGURE B-96


BEDFORD BASIN
PRINCE
GYP
GRAV.
ED.
5
2
4
2
5
3
4
3
5
WIND 100° T
LAUNCH
TIDE
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO SMALL MAST
STATIONS: ED, GRAV
MEAN BUOY SPEED: 7.1 m/min
MEAN WIND SPEED: 6.4 m/s

TRIAL: 22
DATE: JUN 2/82 pm
1207-1430

FIGURE B-97

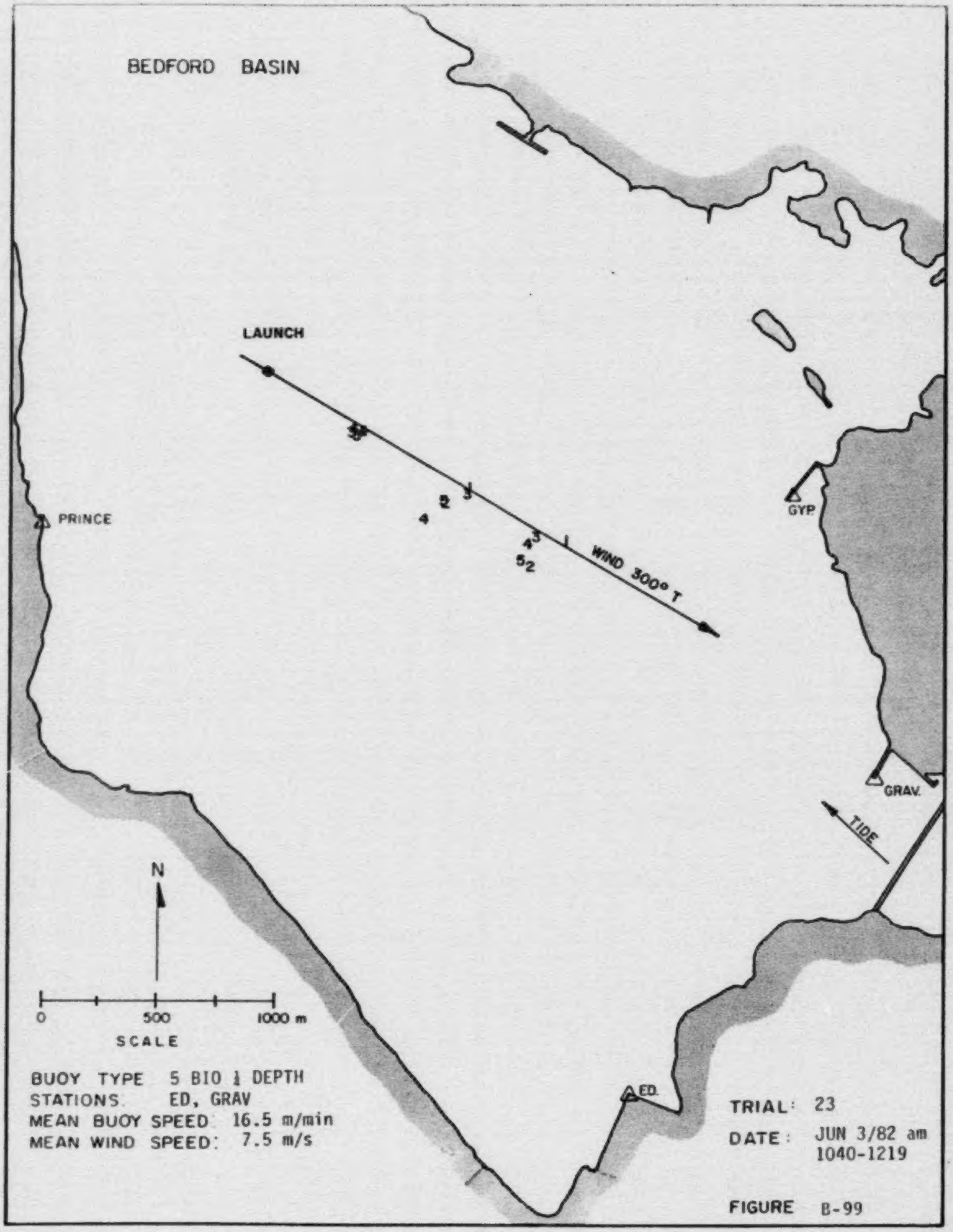


BUOY SPEED (ABSOLUTE ,AT
TIME BETWEEN FIXES). Vs TIME (ELAPSED)

LEGEND

¼ - BIO QUARTER DEPTH
½ - BIO HALF DEPTH
S - BIO SMALL MAST
X - BIO NO MAST
— — WIND

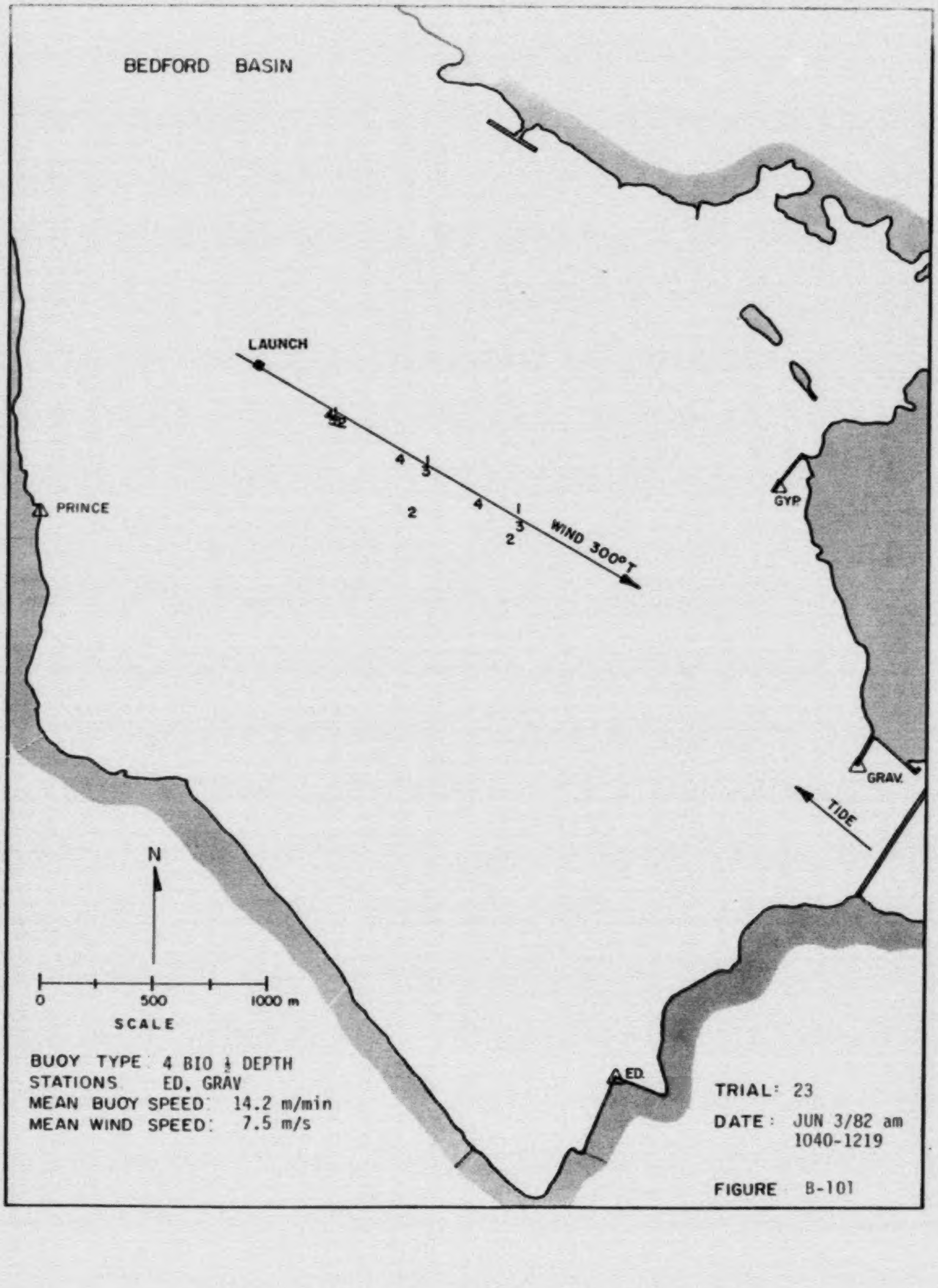
TRIAL : 22
DATE : JUN 2/82, 1207-1430
TIDE : LOW - 1120
HI - 1725
AV. WIND SPEED : 6.4 m/s
FIGURE : B-98


BEDFORD BASIN
LAUNCH
WIND 300° T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE 5 BIO ½ DEPTH
STATIONS ED, GRAV
MEAN BUOY SPEED 16.5 m/min
MEAN WIND SPEED: 7.5 m/s

TRIAL: 23
DATE: JUN 3/82 am
1040-1219

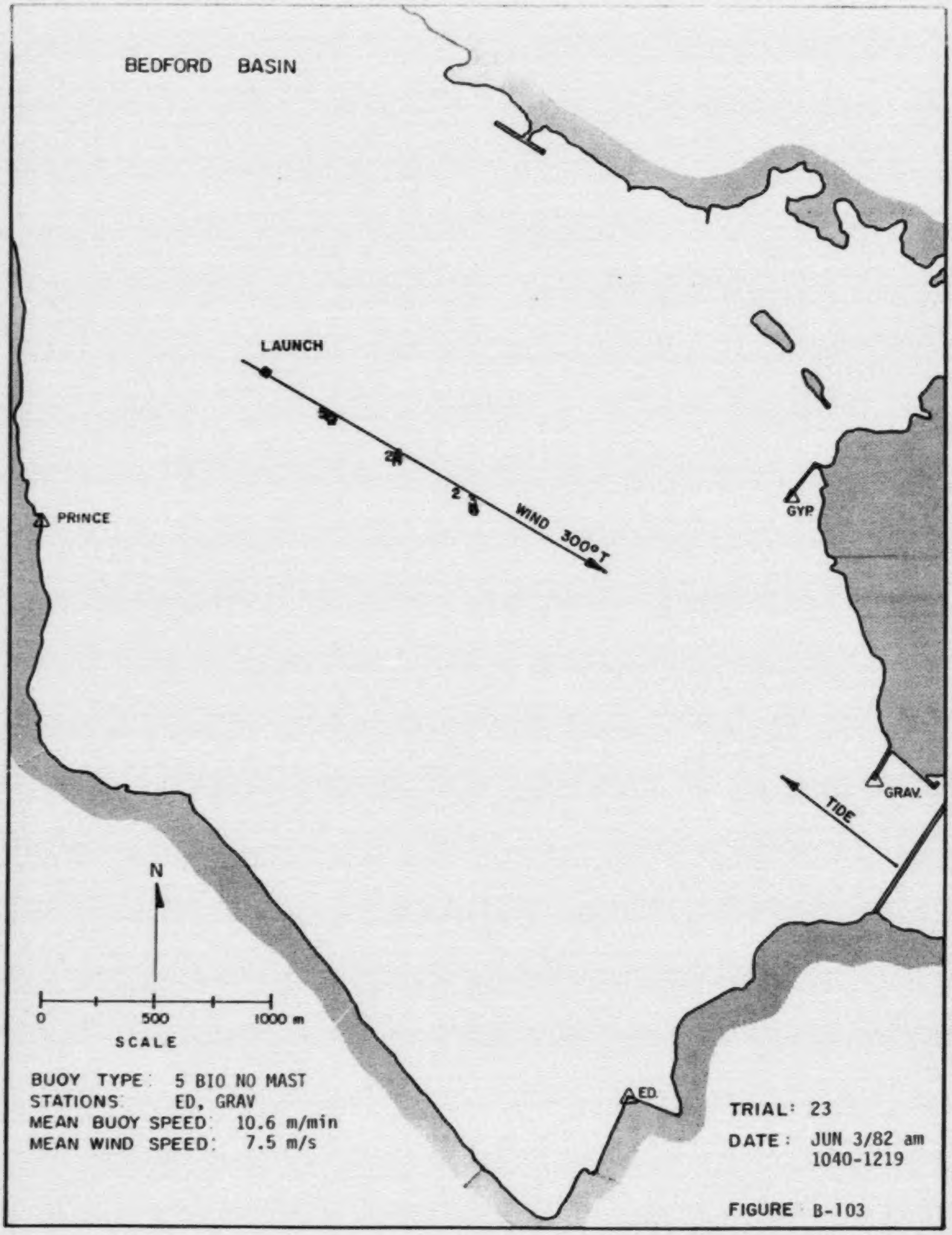
FIGURE B-99


BEDFORD BASIN
LAUNCH
4
3
2
1
PRINCE
WIND 300°T
GYP
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 4 BIO ½ DEPTH
STATIONS: ED, GRAV
MEAN BUOY SPEED: 14.2 m/min
MEAN WIND SPEED: 7.5 m/s

TRIAL: 23
DATE: JUN 3/82 am
1040-1219

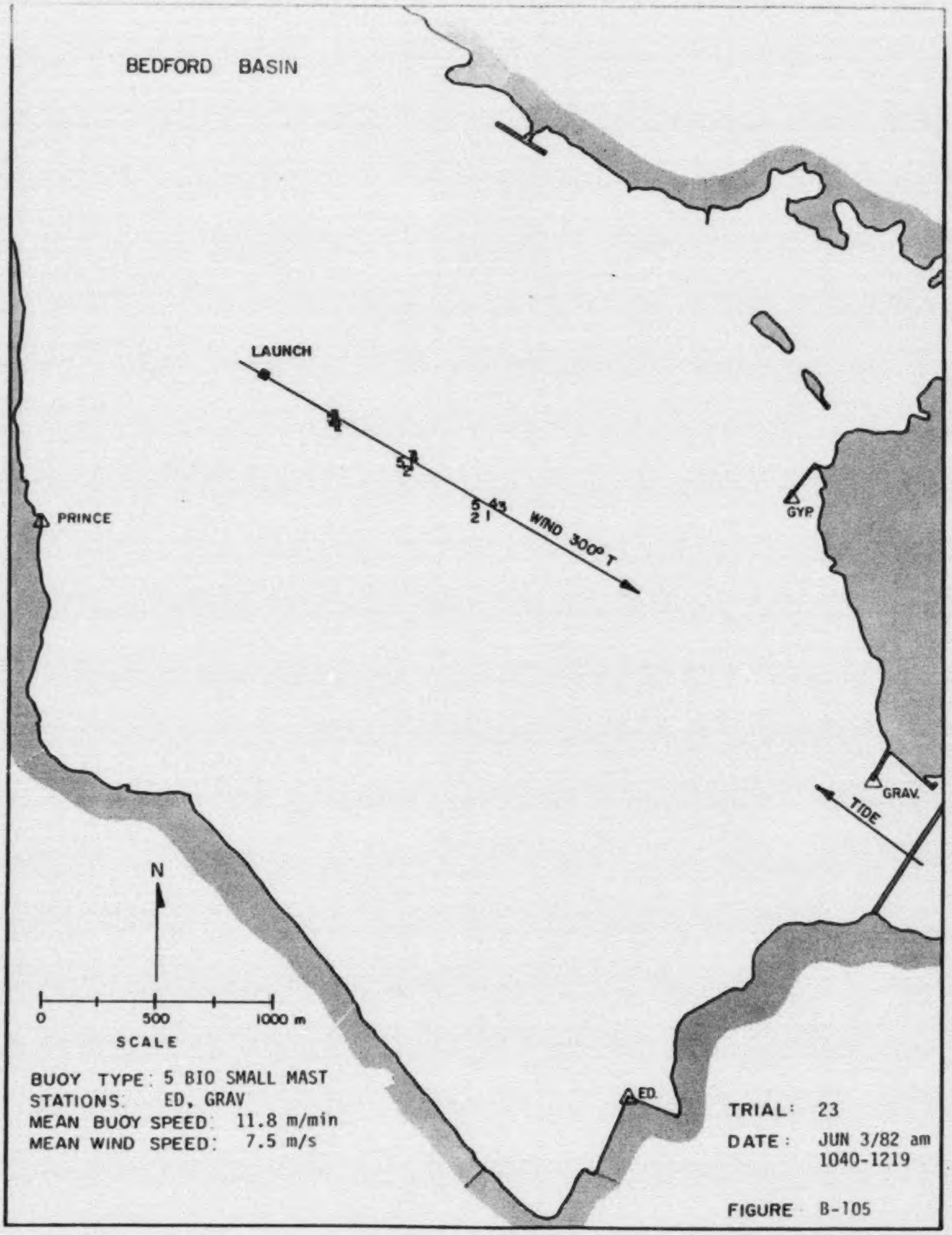
FIGURE B-101


BEDFORD BASIN
LAUNCH
WIND 300°T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO NO MAST
STATIONS: ED, GRAV
MEAN BUOY SPEED: 10.6 m/min
MEAN WIND SPEED: 7.5 m/s

TRIAL: 23
DATE: JUN 3/82 am
1040-1219

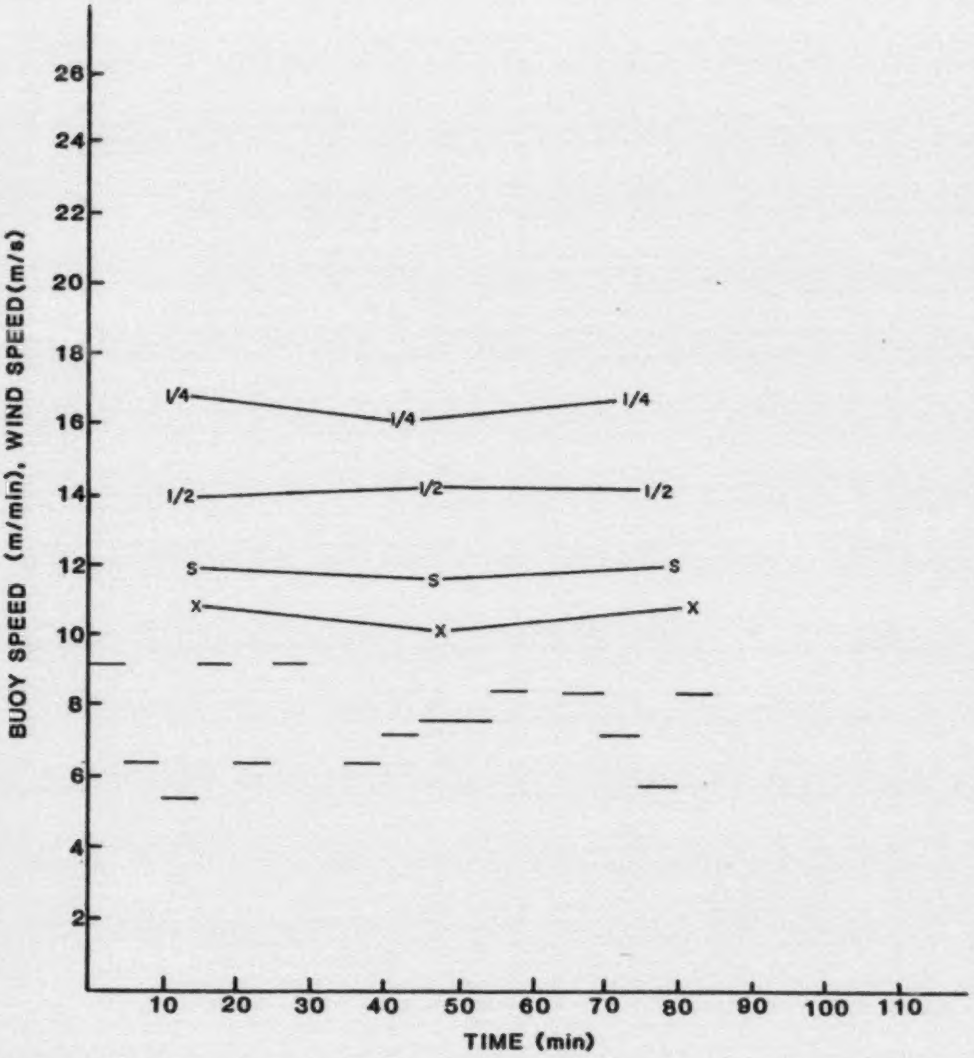
FIGURE B-103


BEDFORD BASIN
LAUNCH
PRINCE
GYP.
WIND 300° T
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO SMALL MAST
STATIONS: ED, GRAV
MEAN BUOY SPEED: 11.8 m/min
MEAN WIND SPEED: 7.5 m/s

TRIAL: 23
DATE: JUN 3/82 am
1040-1219

FIGURE B-105

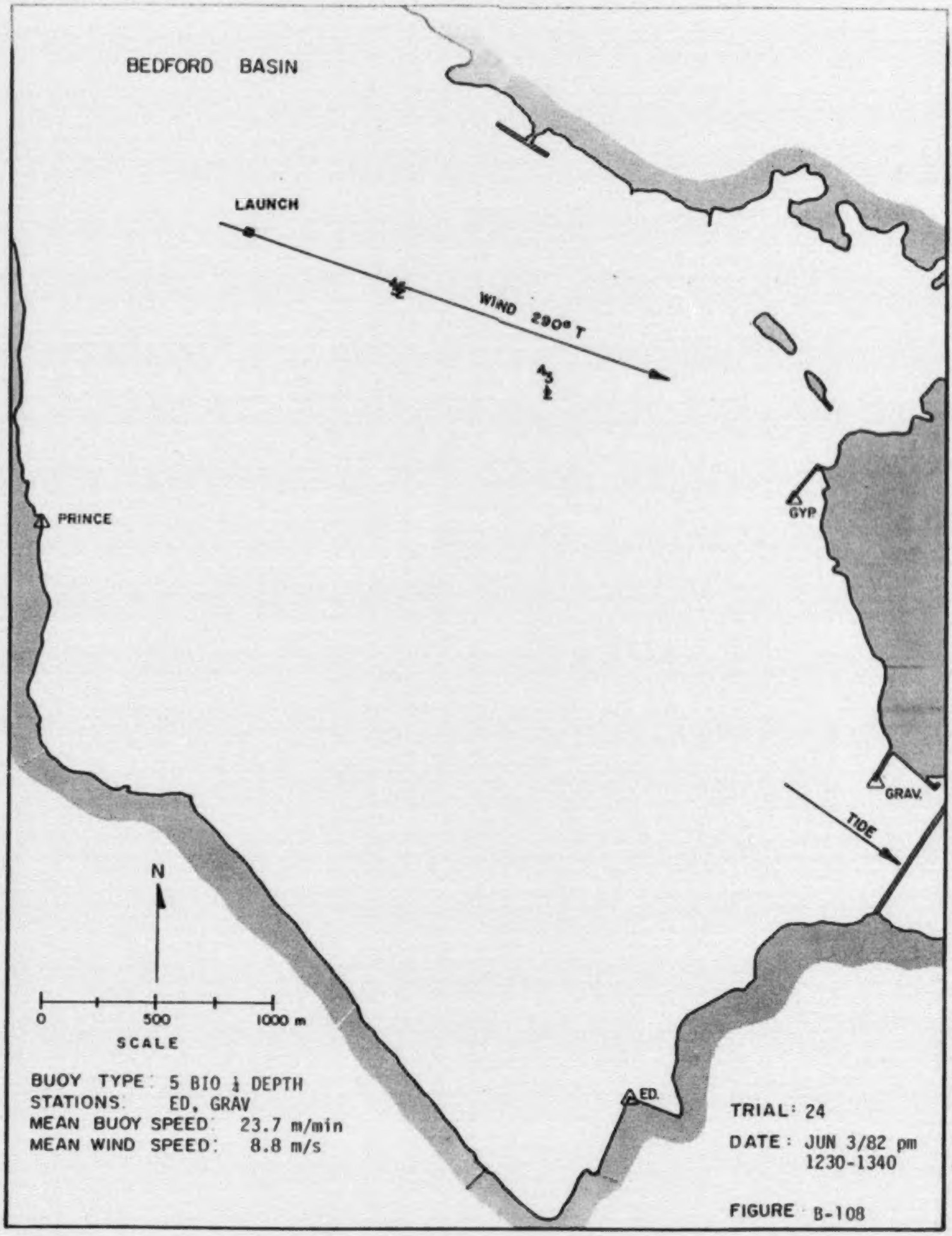


BUOY SPEED (ABSOLUTE ,AT
TIME BETWEEN FIXES). Vs TIME (ELAPSED)

LEGEND

¼ - BIO QUARTER DEPTH
½ - BIO HALF DEPTH
S - BIO SMALL MAST
X - BIO NO MAST
— — WIND

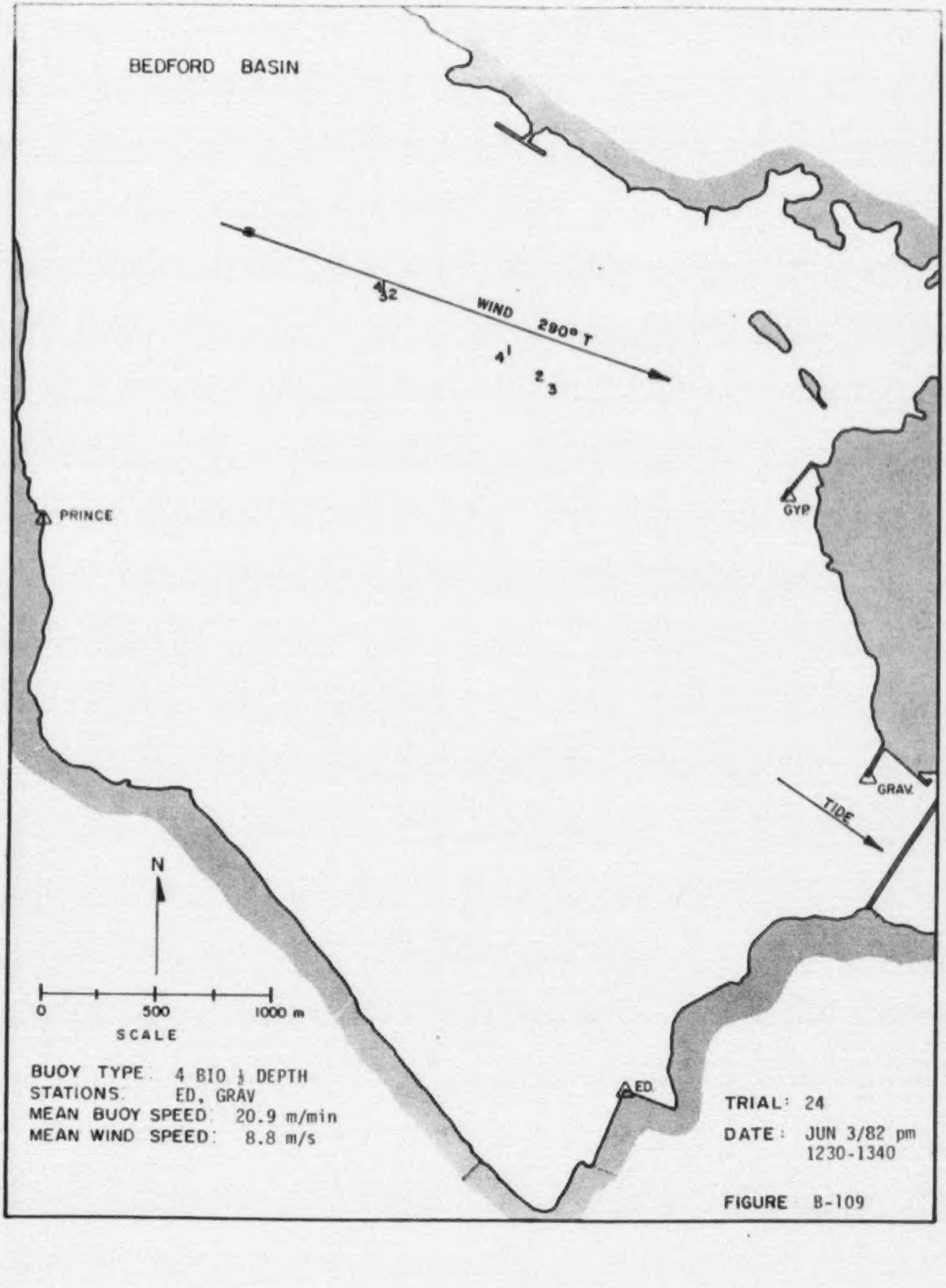
TRIAL : 23
DATE : JUN 3/83, 1040-1219
TIDE : HI - 0555
LOW - 1210
AV. WIND SPEED : 7.5 m/s
FIGURE : B-107


BEDFORD BASIN
LAUNCH
WIND 290° T
PRINCE
GYP
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO ½ DEPTH
STATIONS: ED, GRAV
MEAN BUOY SPEED: 23.7 m/min
MEAN WIND SPEED: 8.8 m/s

TRIAL: 24
DATE: JUN 3/82 pm
1230-1340

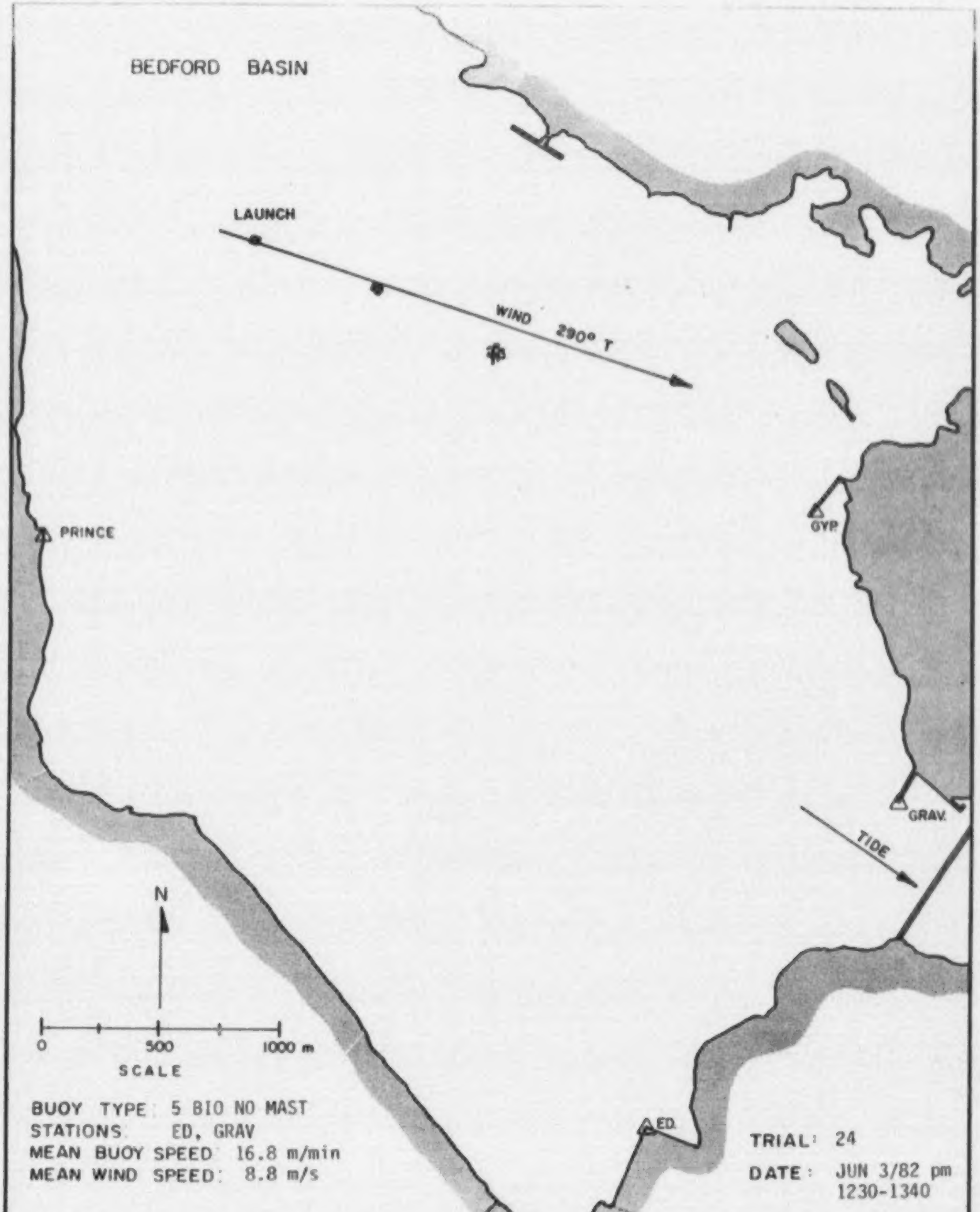
FIGURE B-108


BEDFORD BASIN
4
3 2
WIND 290° T
4 1
2 3
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 4 BIO ½ DEPTH
STATIONS: ED, GRAV
MEAN BUOY SPEED: 20.9 m/min
MEAN WIND SPEED: 8.8 m/s

TRIAL: 24
DATE: JUN 3/82 pm
1230-1340

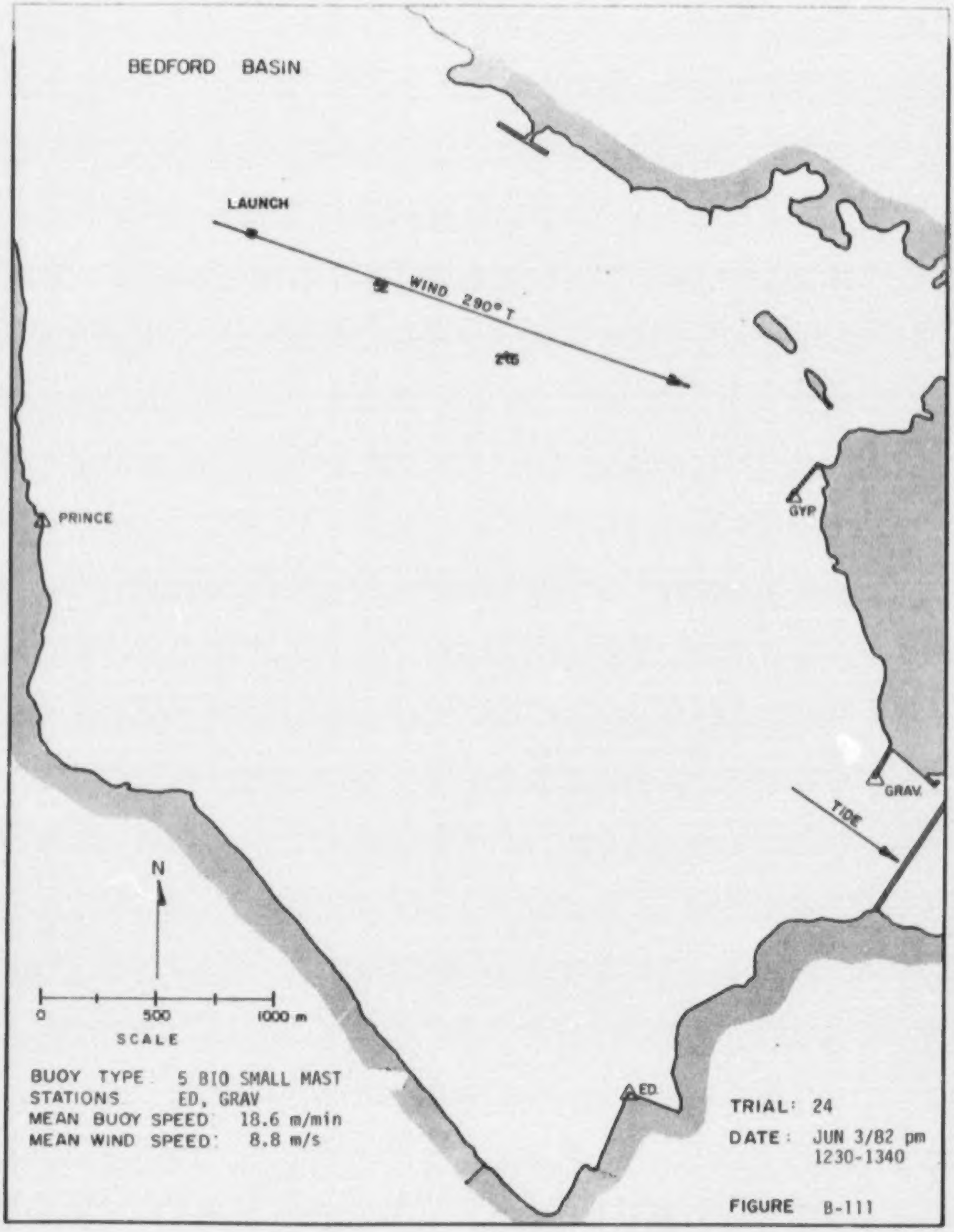
FIGURE B-109


BEDFORD BASIN
LAUNCH
WIND 290° T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO NO MAST
STATIONS: ED, GRAV
MEAN BUOY SPEED: 16.8 m/min
MEAN WIND SPEED: 8.8 m/s

TRIAL: 24
DATE: JUN 3/82 pm
1230-1340

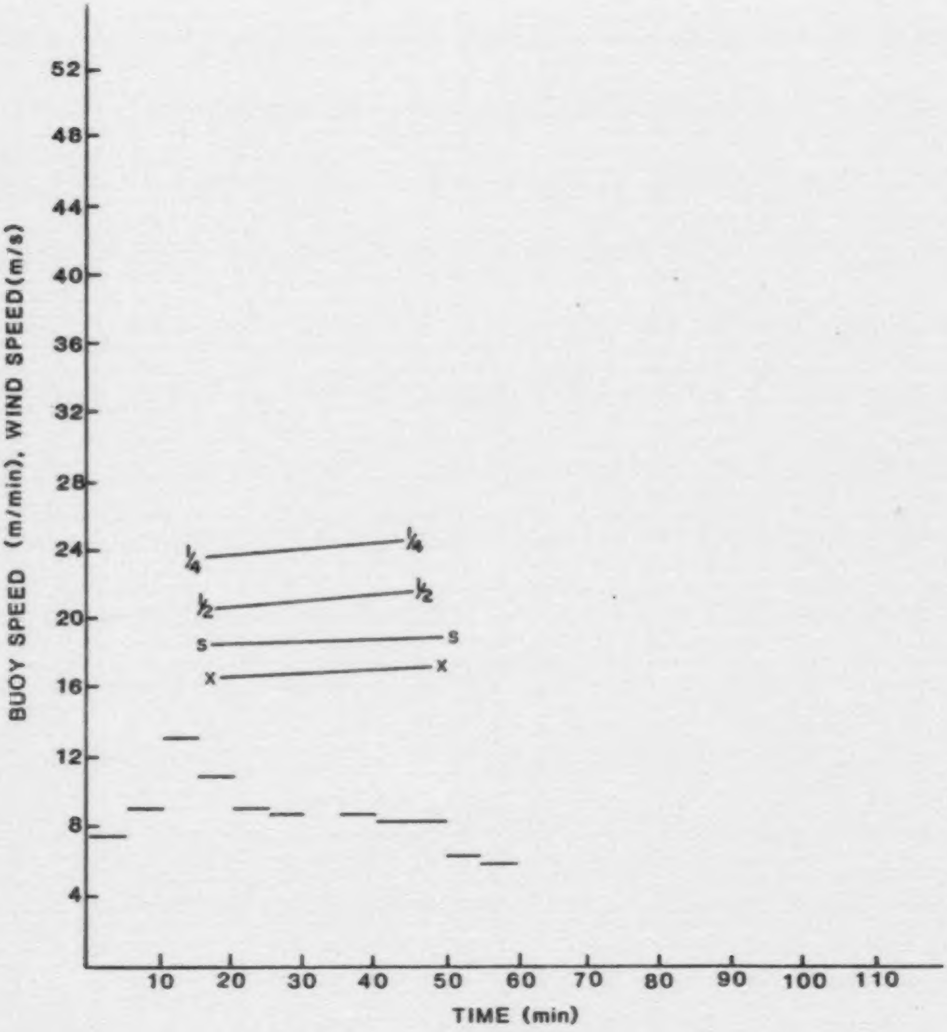
FIGURE B-110


BEDFORD BASIN
LAUNCH
WIND 290° T
PRINCE
GYP
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE 5 BIO SMALL MAST
STATIONS ED, GRAV
MEAN BUOY SPEED 18.6 m/min
MEAN WIND SPEED 8.8 m/s

TRIAL: 24
DATE: JUN 3/82 pm
1230-1340

FIGURE B-111



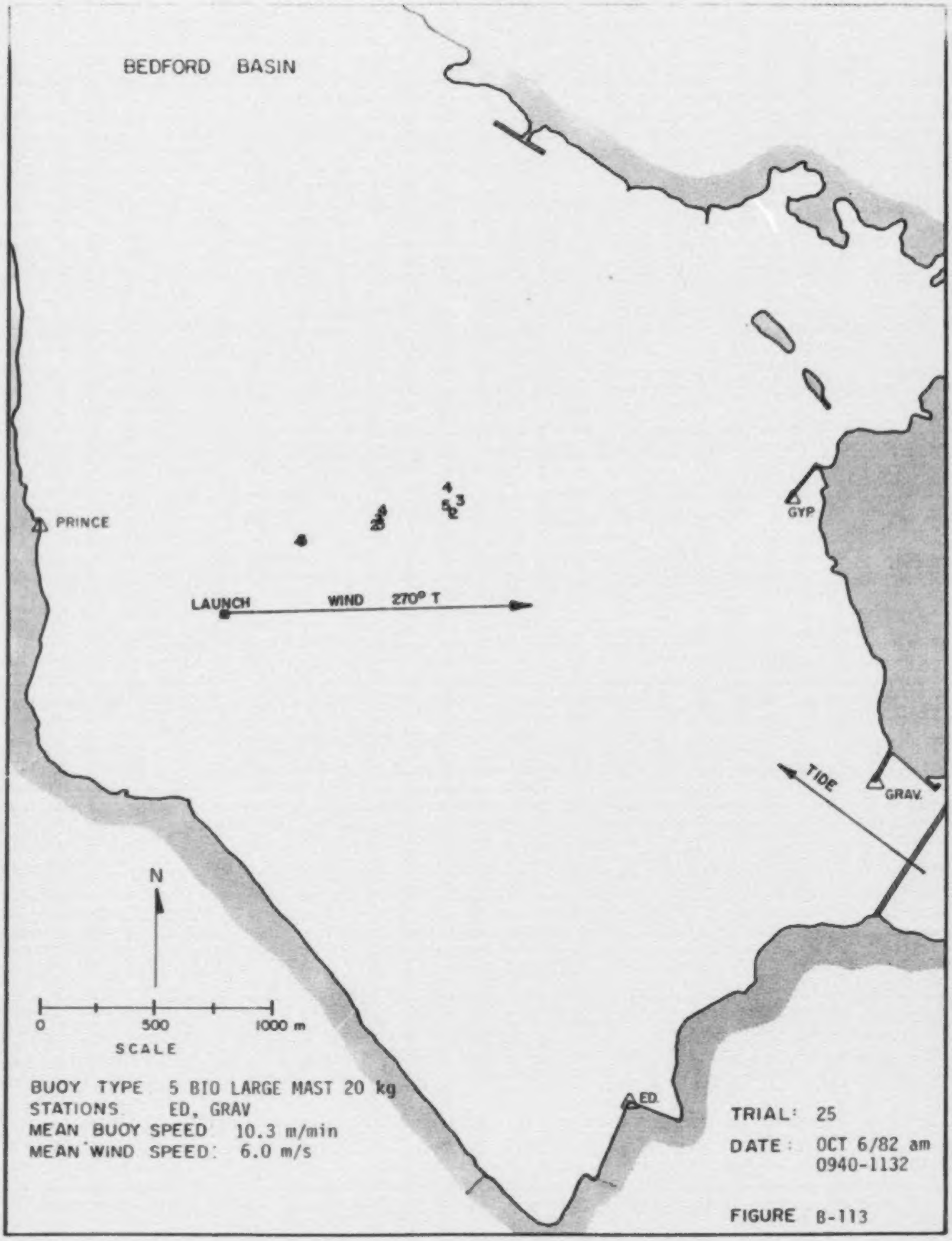
BUOY SPEED (ABSOLUTE ,AT

TIME BETWEEN FIXES). Vs TIME (ELAPSED)

LEGEND

¼ - BIO QUARTER DEPTH
½ - BIO HALF DEPTH
S - BIO SMALL MAST
X - BIO NO MAST
— — WIND

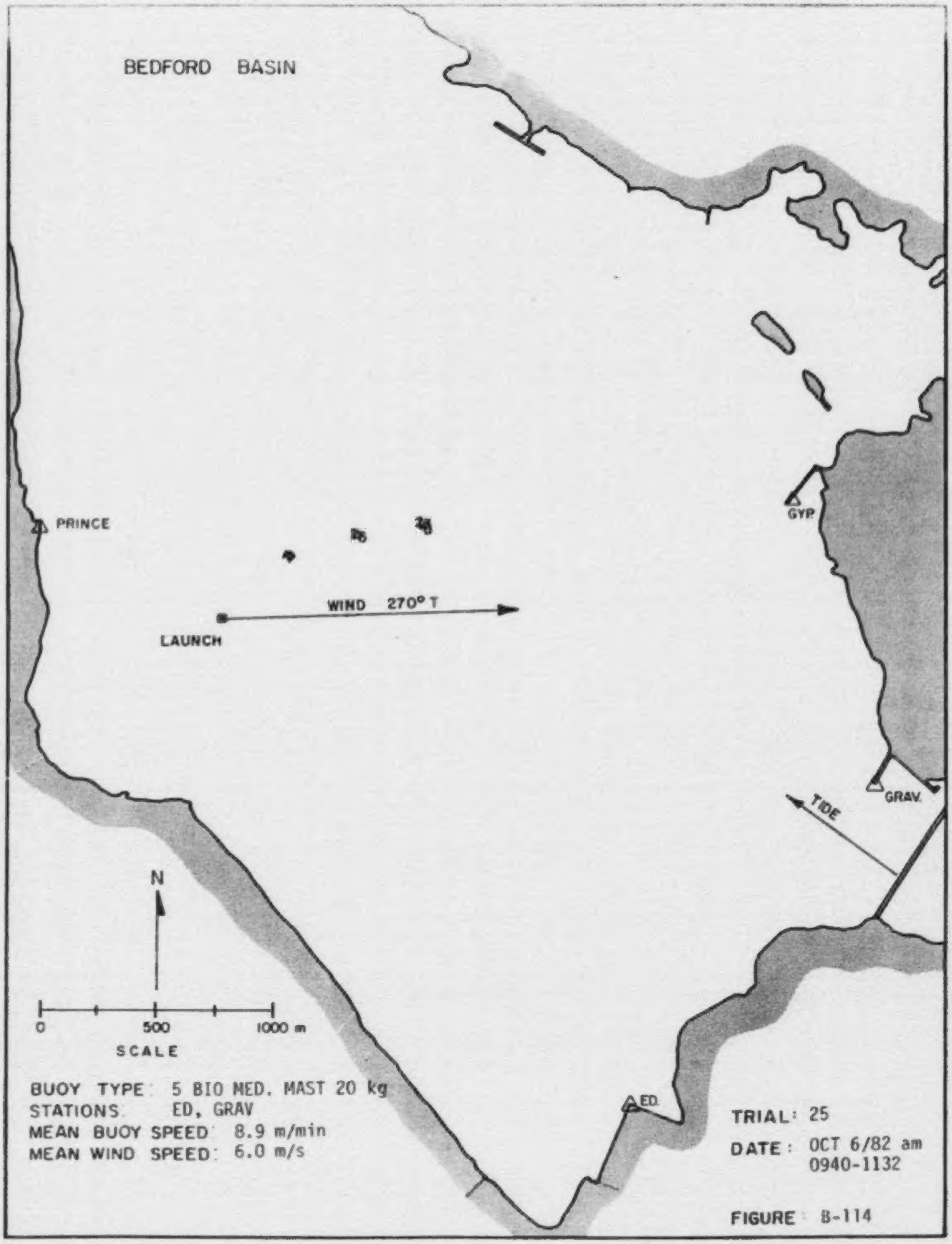
TRIAL : 24
DATE : JUN 3/83, 1230-1340
TIDE : LOW - 1210
HI - 1800
AV. WIND SPEED : 8.8 m/s
FIGURE : B-112


BEDFORD BASIN
PRINCE
GYP
LAUNCH
WIND 270° T
TIDE
GRAV.
ED.
N
0
500
1000 m
SCALE

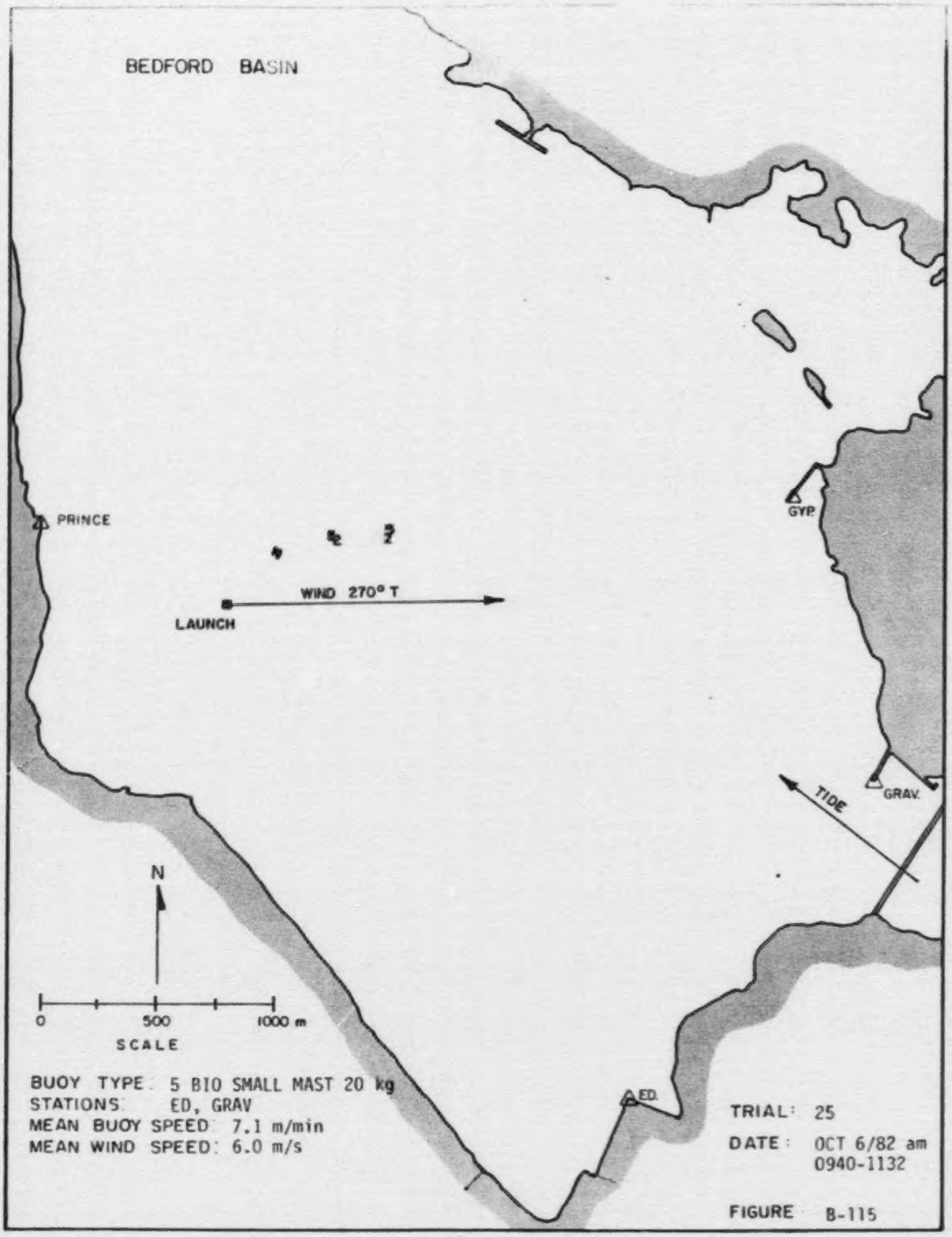
BUOY TYPE 5 BIO LARGE MAST 20 kg
STATIONS ED, GRAV
MEAN BUOY SPEED 10.3 m/min
MEAN WIND SPEED: 6.0 m/s

TRIAL: 25
DATE: OCT 6/82 am
0940-1132

FIGURE B-113


BEDFORD BASIN
PRINCE
GYP.
WIND 270° T
LAUNCH
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.
BUOY TYPE: 5 BIO MED. MAST 20 kg
STATIONS: ED, GRAV
MEAN BUOY SPEED: 8.9 m/min
MEAN WIND SPEED: 6.0 m/s
TRIAL: 25
DATE: OCT 6/82 am
0940-1132
FIGURE: B-114

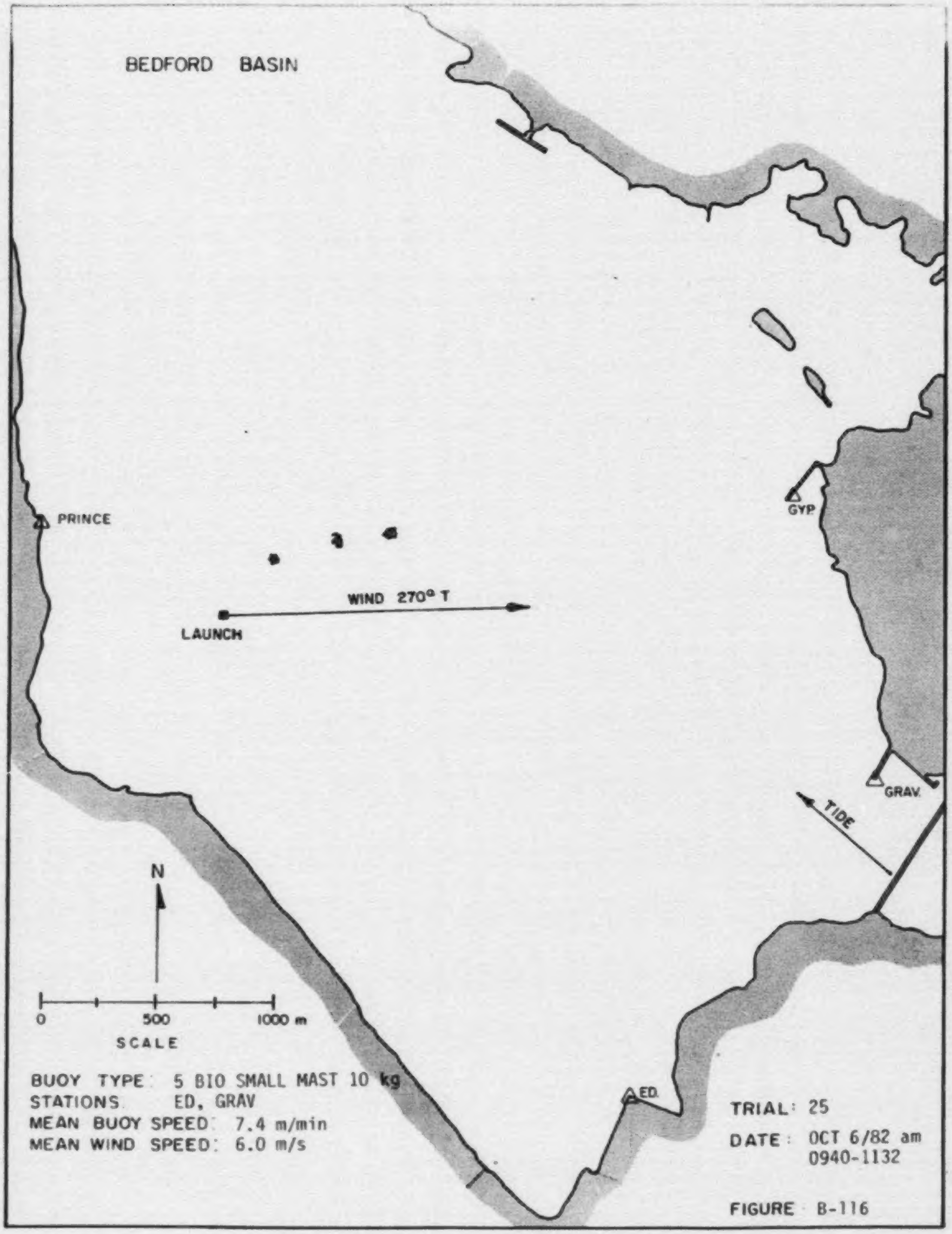
BEDFORD BASIN


PRINCE
GYP.
LAUNCH
WIND 270° T
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO SMALL MAST 20 kg
STATIONS: ED, GRAV
MEAN BUOY SPEED: 7.1 m/min
MEAN WIND SPEED: 6.0 m/s

TRIAL: 25
DATE: OCT 6/82 am
0940-1132

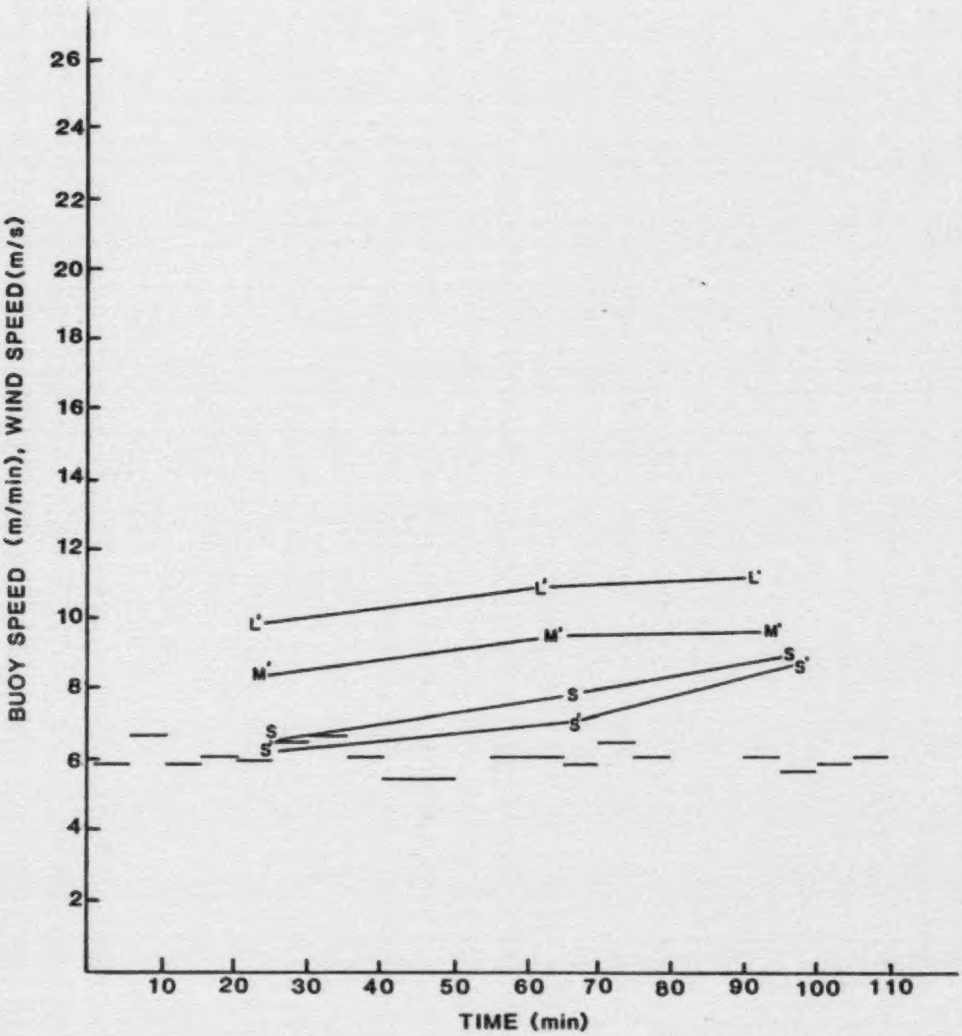
FIGURE B-115


BEDFORD BASIN
PRINCE
GYP
GRAV.
ED.
LAUNCH
WIND 270° T
TIDE
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO SMALL MAST 10 kg
STATIONS: ED, GRAV
MEAN BUOY SPEED: 7.4 m/min
MEAN WIND SPEED: 6.0 m/s

TRIAL: 25
DATE: OCT 6/82 am
0940-1132

FIGURE B-116

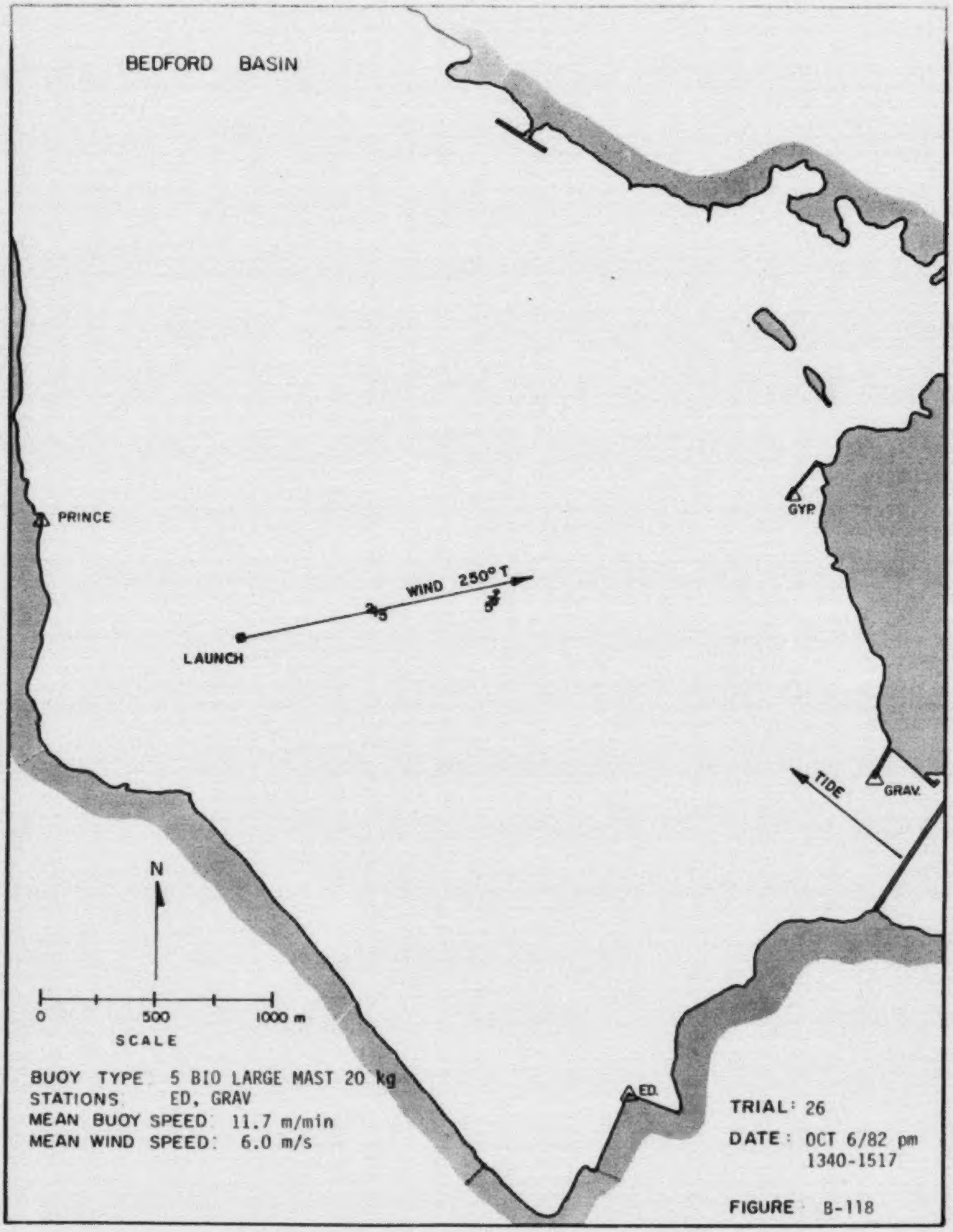


BUOY SPEED (ABSOLUTE ,AT
TIME BETWEEN FIXES). Vs TIME (ELAPSED)

LEGEND

L' - BIO LARGE MAST 20 kg
M' - BIO MED. MAST 20 kg
S' - BIO SMALL MAST 20 kg
S - BIO SMALL MAST 10 kg
— — WIND

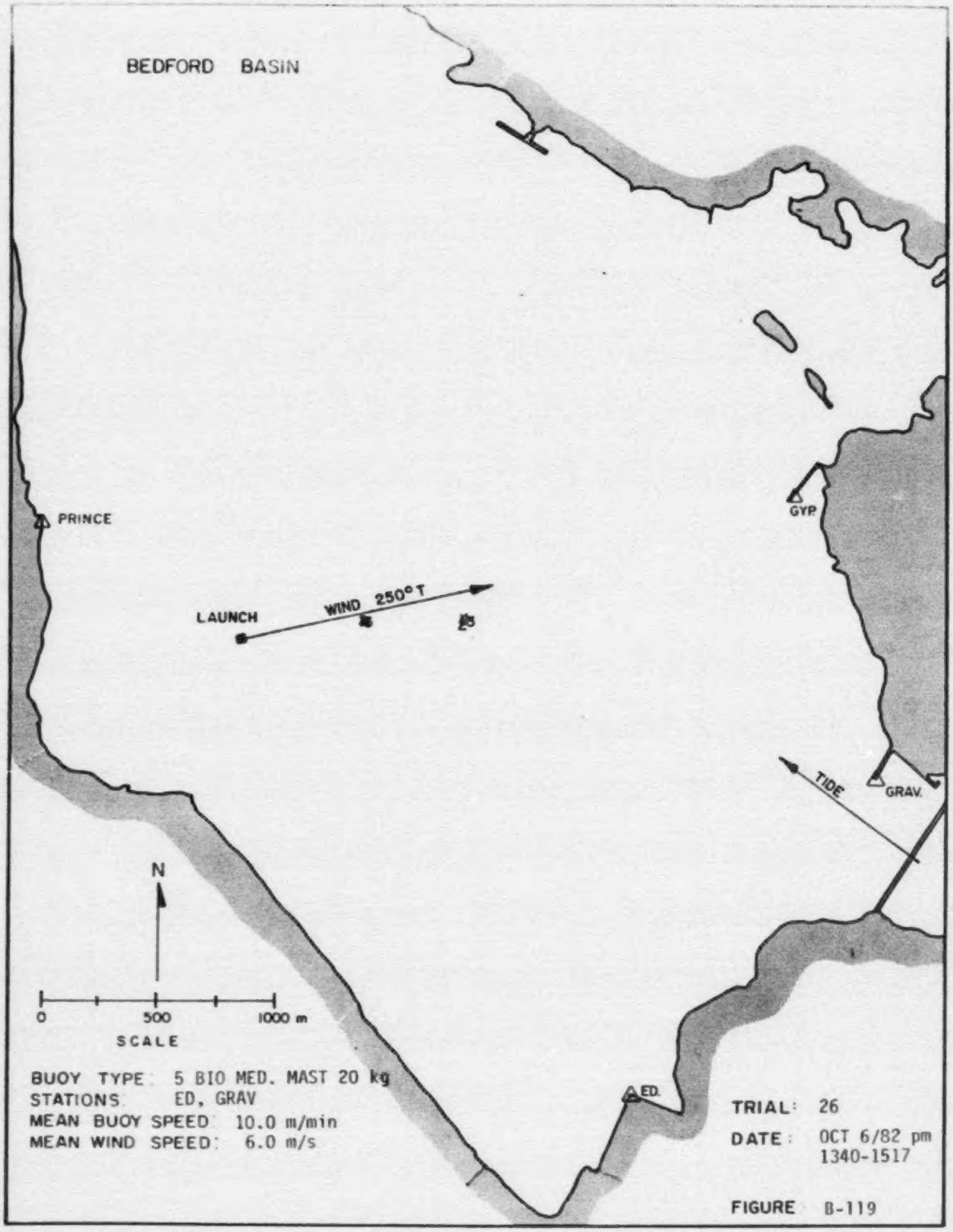
TRIAL :	25
DATE :	OCT 6/82, 0940-1132
TIDE :	HI - 0955 LOW - 1640
AV. WIND SPEED :	6.0 m/s
FIGURE :	B-117


BEDFORD BASIN
PRINCE
GYP
WIND 250° T
2
5
LAUNCH
TIDE
GRAV.
ED.
N
0
500
1000 m
SCALE

BUOY TYPE 5 BIO LARGE MAST 20 kg
STATIONS ED, GRAV
MEAN BUOY SPEED 11.7 m/min
MEAN WIND SPEED: 6.0 m/s

TRIAL: 26
DATE: OCT 6/82 pm
1340-1517

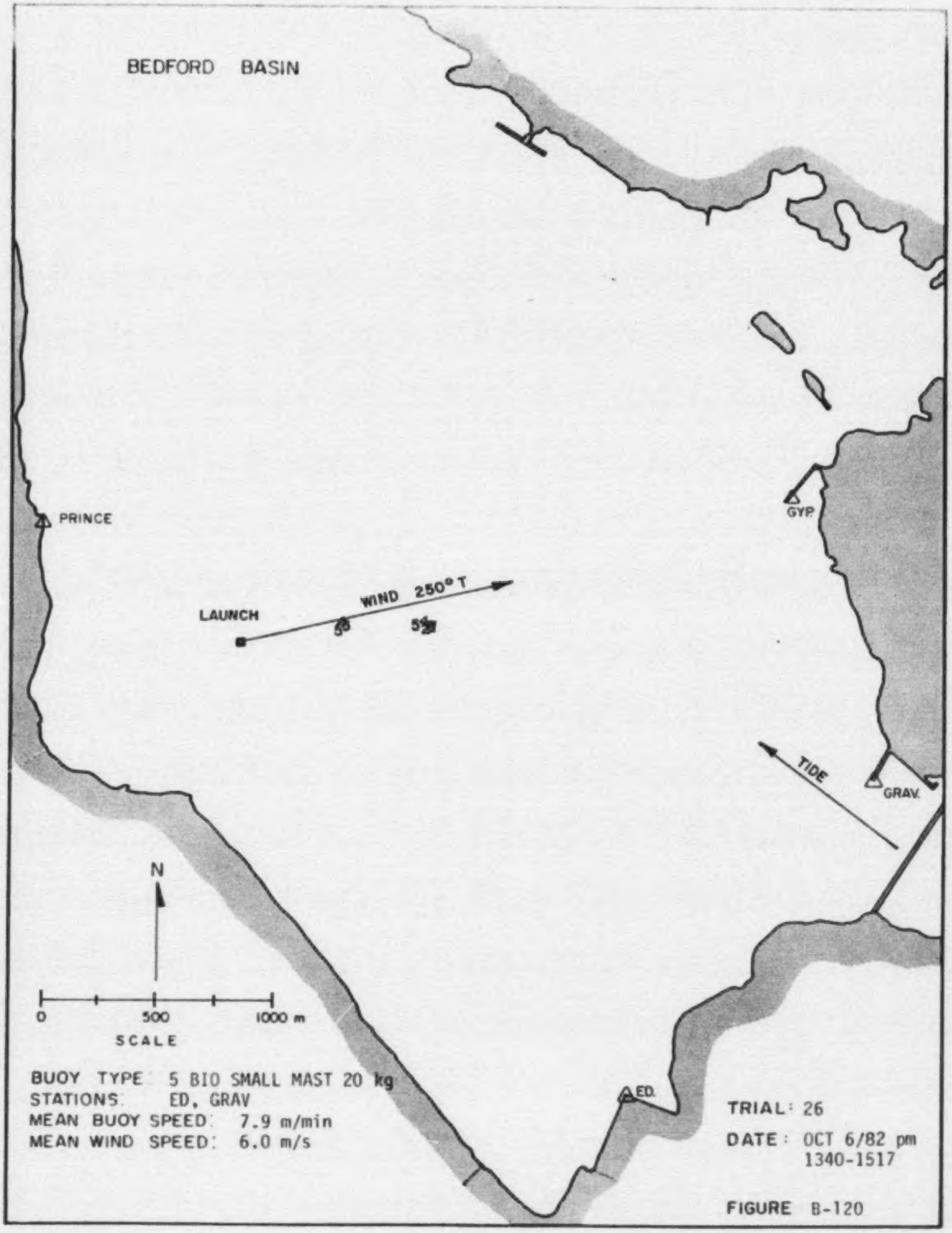
FIGURE B-118


BEDFORD BASIN
PRINCE
GYP.
LAUNCH
WIND 250° T
TIDE
GRAV.
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO MED. MAST 20 kg
STATIONS: ED, GRAV
MEAN BUOY SPEED: 10.0 m/min
MEAN WIND SPEED: 6.0 m/s

TRIAL: 26
DATE: OCT 6/82 pm
1340-1517

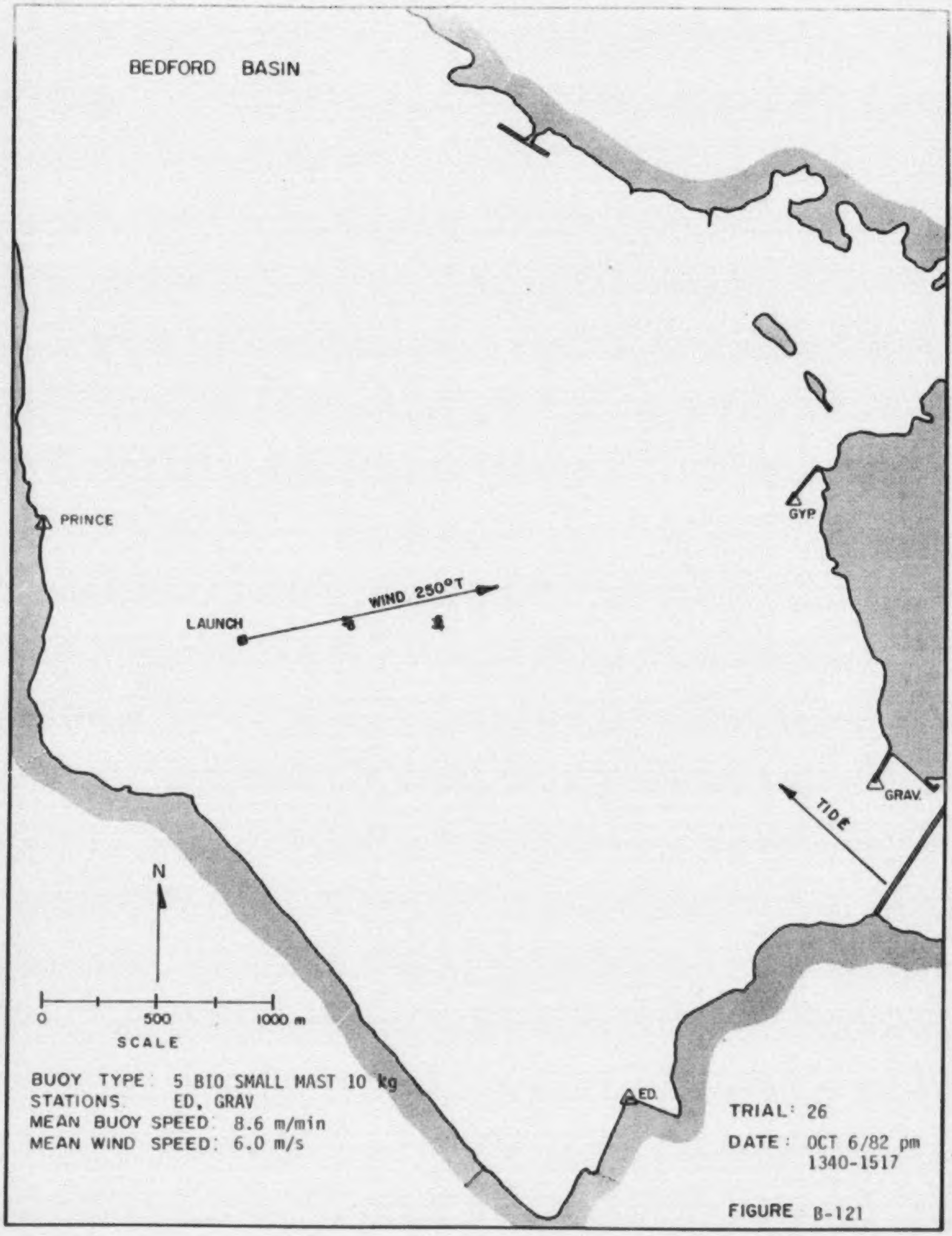
FIGURE B-119


BEDFORD BASIN
PRINCE
GYP.
LAUNCH
WIND 250° T
TIDE
GRAV.
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO SMALL MAST 20 kg
STATIONS: ED, GRAV
MEAN BUOY SPEED: 7.9 m/min
MEAN WIND SPEED: 6.0 m/s

TRIAL: 26
DATE: OCT 6/82 pm
1340-1517

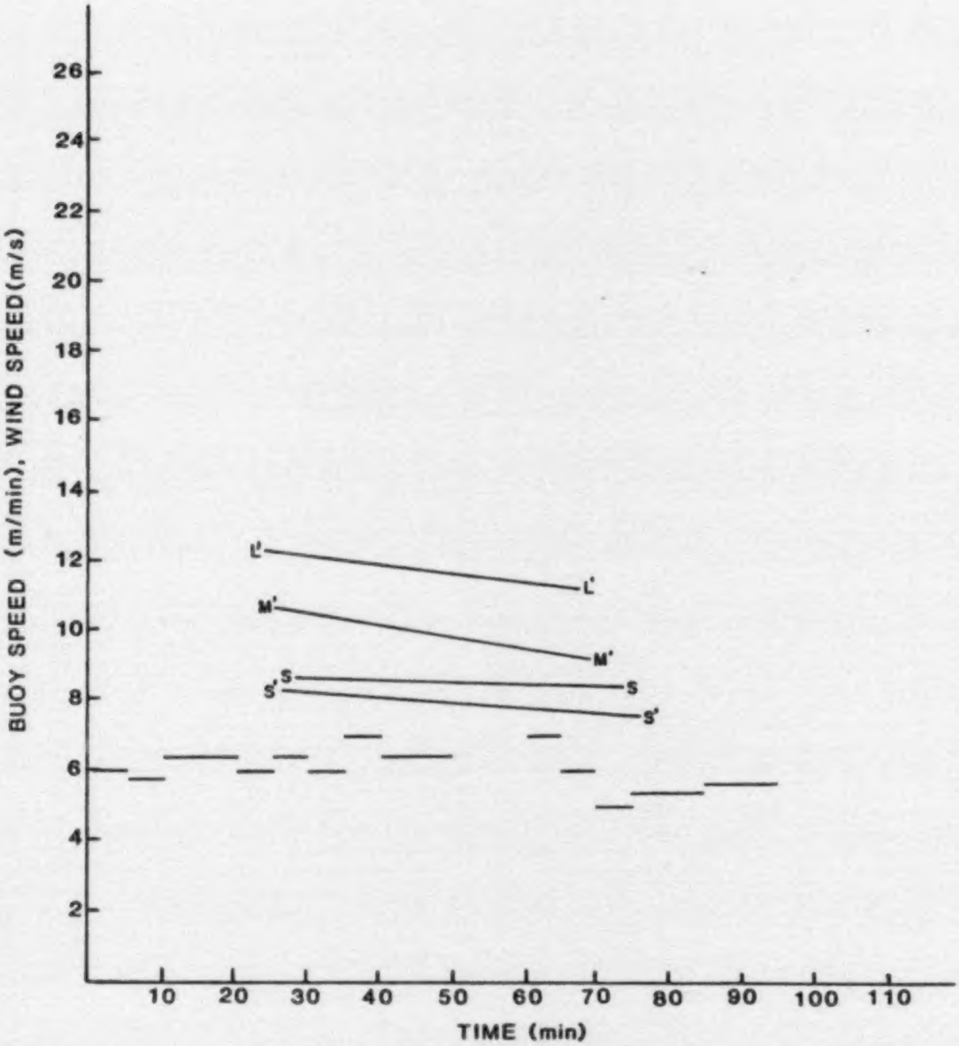
FIGURE B-120


BEDFORD BASIN
PRINCE
GYP.
LAUNCH
WIND 250°T
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO SMALL MAST 10 kg
STATIONS: ED, GRAV
MEAN BUOY SPEED: 8.6 m/min
MEAN WIND SPEED: 6.0 m/s

TRIAL: 26
DATE: OCT 6/82 pm
1340-1517

FIGURE B-121

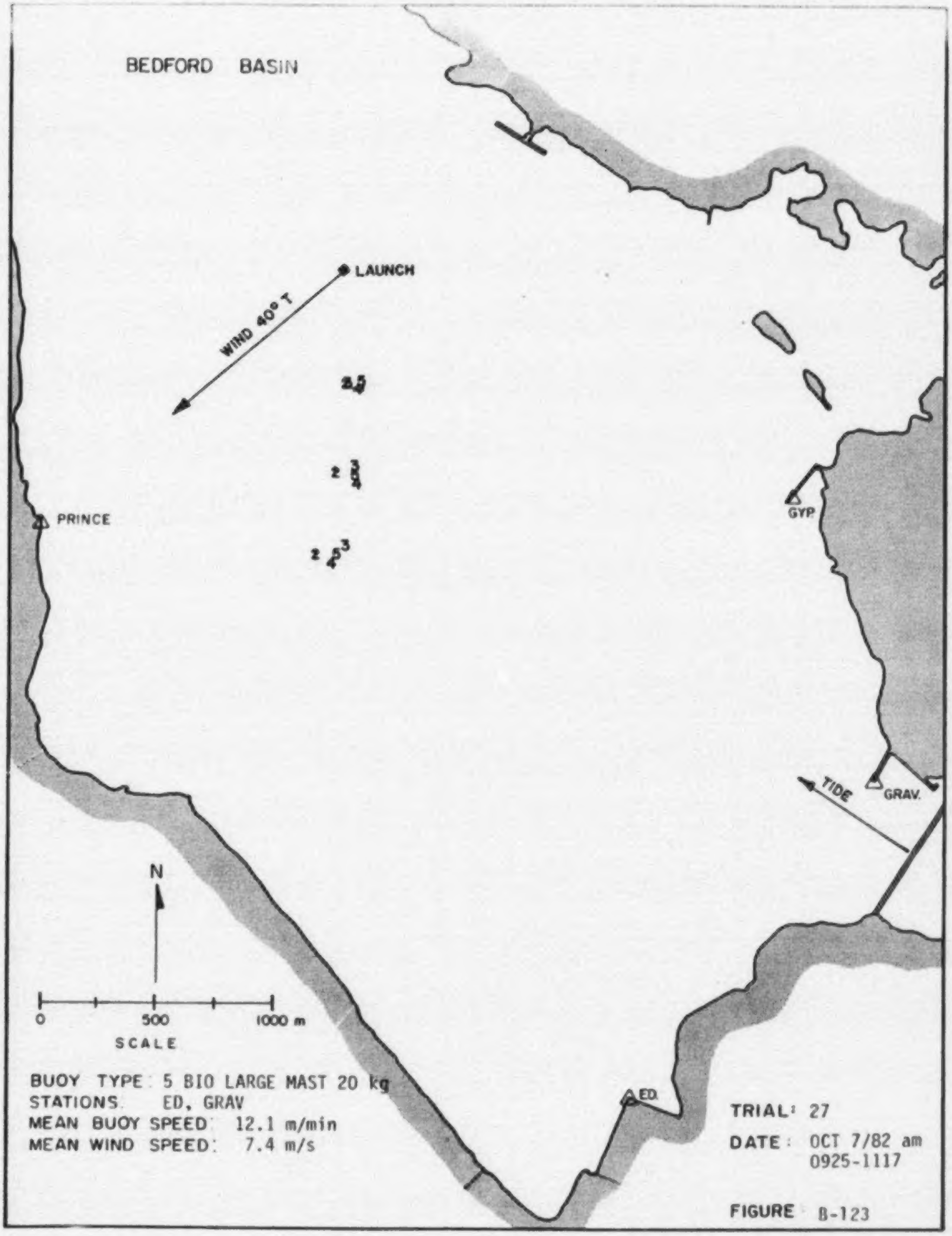


BUOY SPEED (ABSOLUTE ,AT TIME BETWEEN FIXES). Vs TIME (ELAPSED)

LEGEND

L' - BIO LARGE MAST 20 kg
M' - BIO MED. MAST 20 kg
S' - BIO SMALL MAST 20 kg
S - BIO SMALL MAST 10 kg
— — WIND

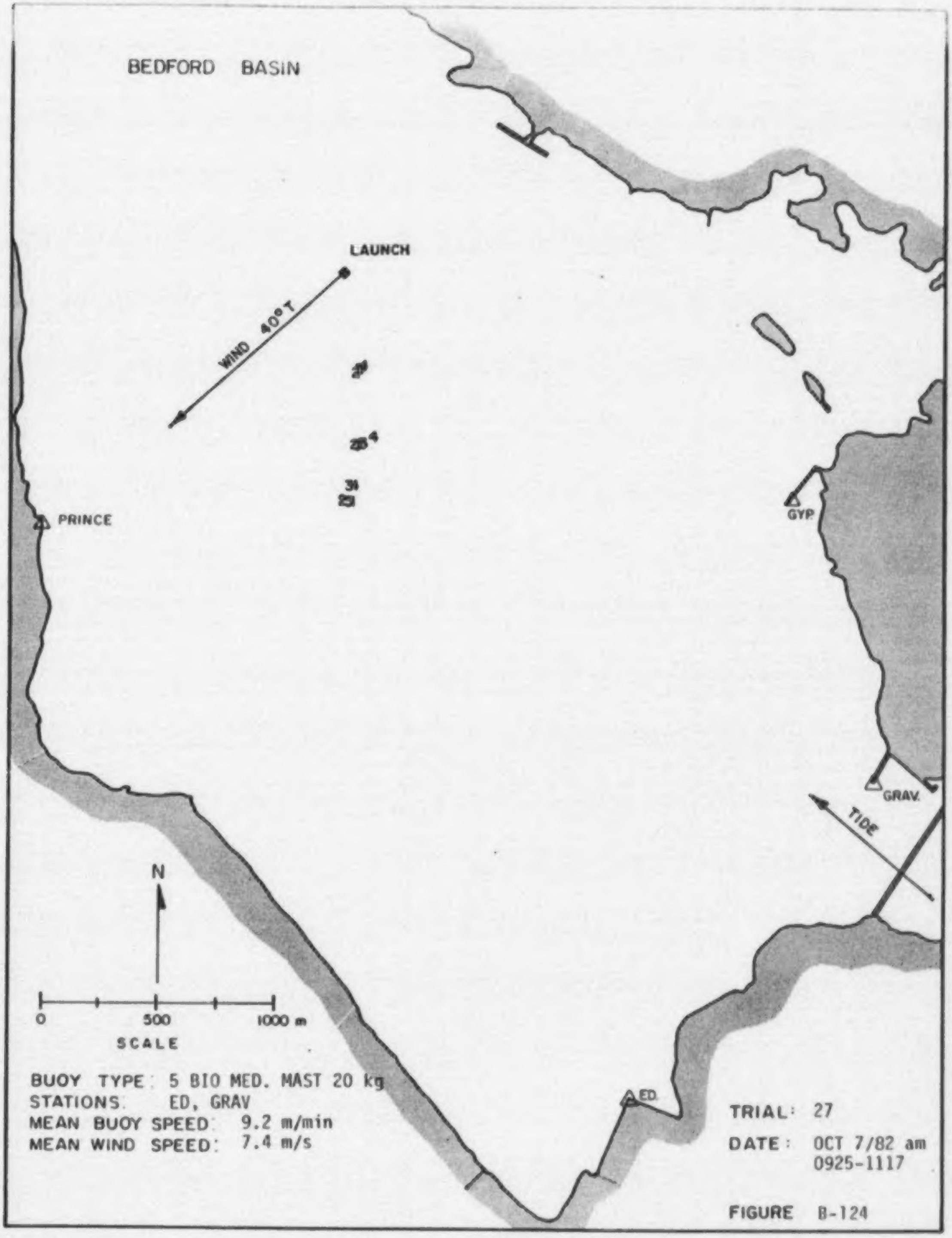
TRIAL : 26
DATE : OCT 6/82, 1340-1517
TIDE : HI - 0955
LOW - 1640
AV. WIND SPEED : 6.0 m/s
FIGURE : B-122


BEDFORD BASIN
LAUNCH
WIND 40° T
2 5
4
2 3
5
4
2 5 3
4
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO LARGE MAST 20 kg
STATIONS: ED, GRAV
MEAN BUOY SPEED: 12.1 m/min
MEAN WIND SPEED: 7.4 m/s

TRIAL: 27
DATE: OCT 7/82 am
0925-1117

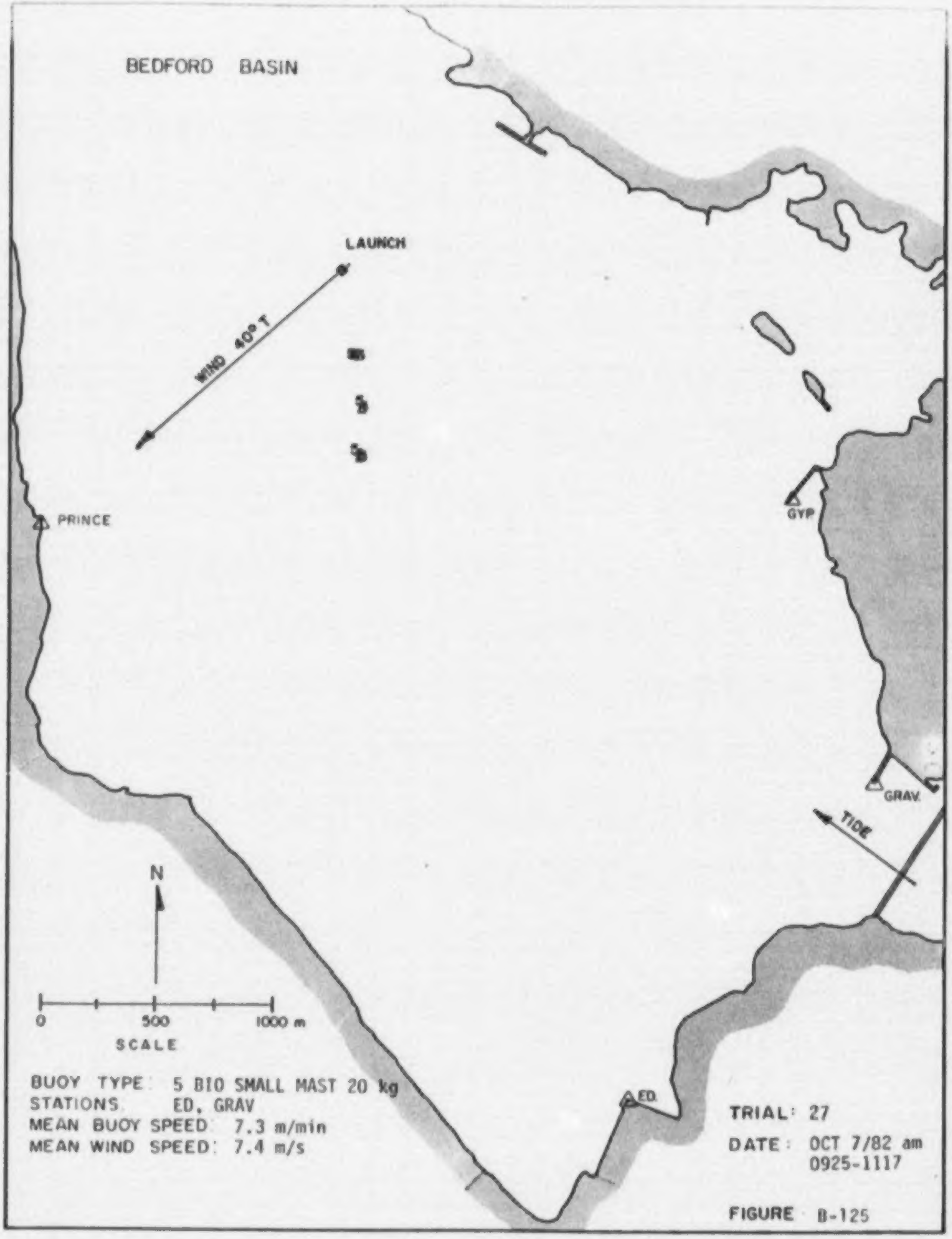
FIGURE B-123


BEDFORD BASIN
LAUNCH
WIND 40°T
4
31
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO MED. MAST 20 kg
STATIONS: ED, GRAV
MEAN BUOY SPEED: 9.2 m/min
MEAN WIND SPEED: 7.4 m/s

TRIAL: 27
DATE: OCT 7/82 am
0925-1117

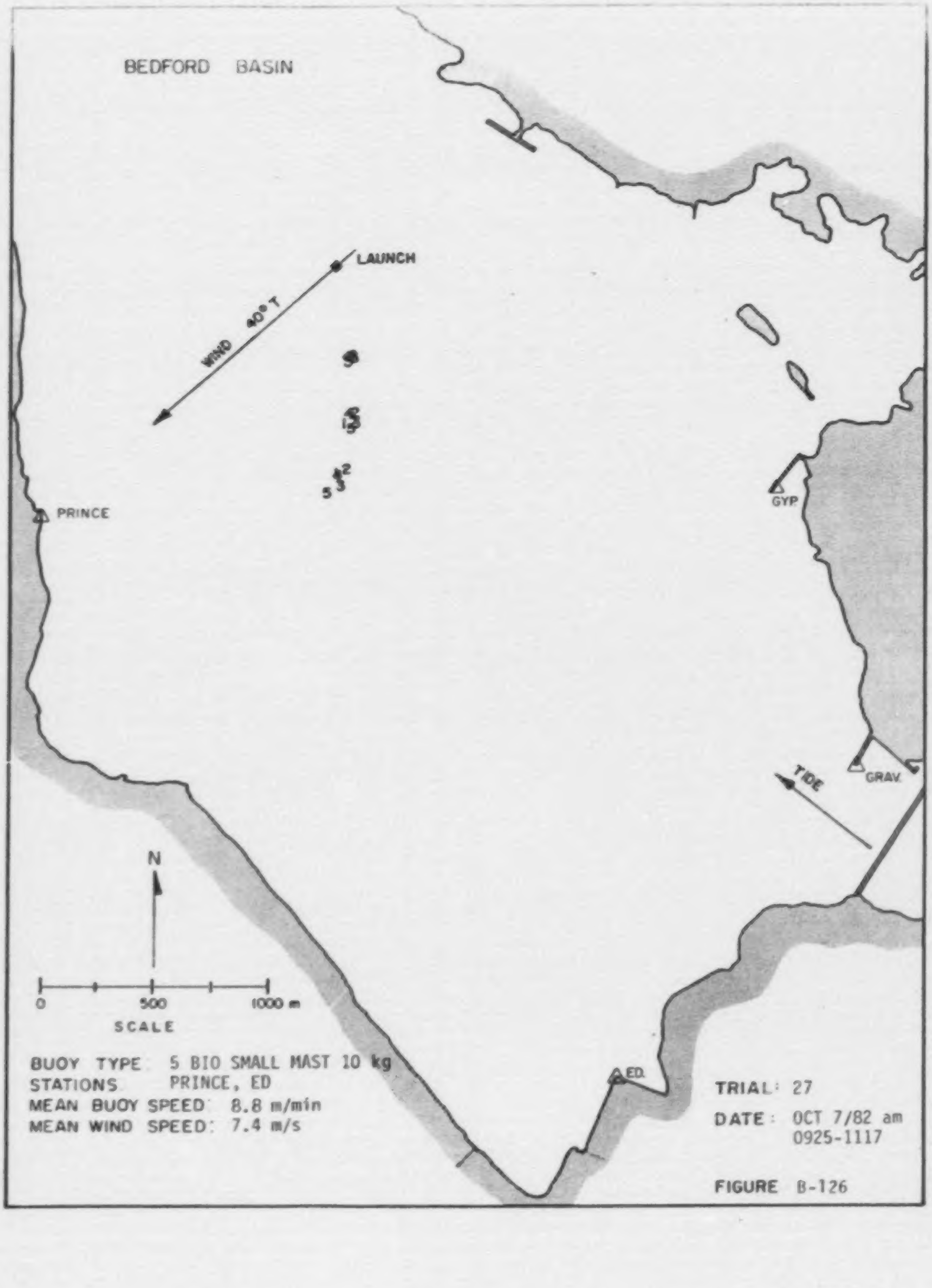
FIGURE B-124


BEDFORD BASIN
LAUNCH
WIND 40° T
PRINCE
GYP
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO SMALL MAST 20 kg
STATIONS: ED, GRAV
MEAN BUOY SPEED: 7.3 m/min
MEAN WIND SPEED: 7.4 m/s

TRIAL: 27
DATE: OCT 7/82 am
0925-1117

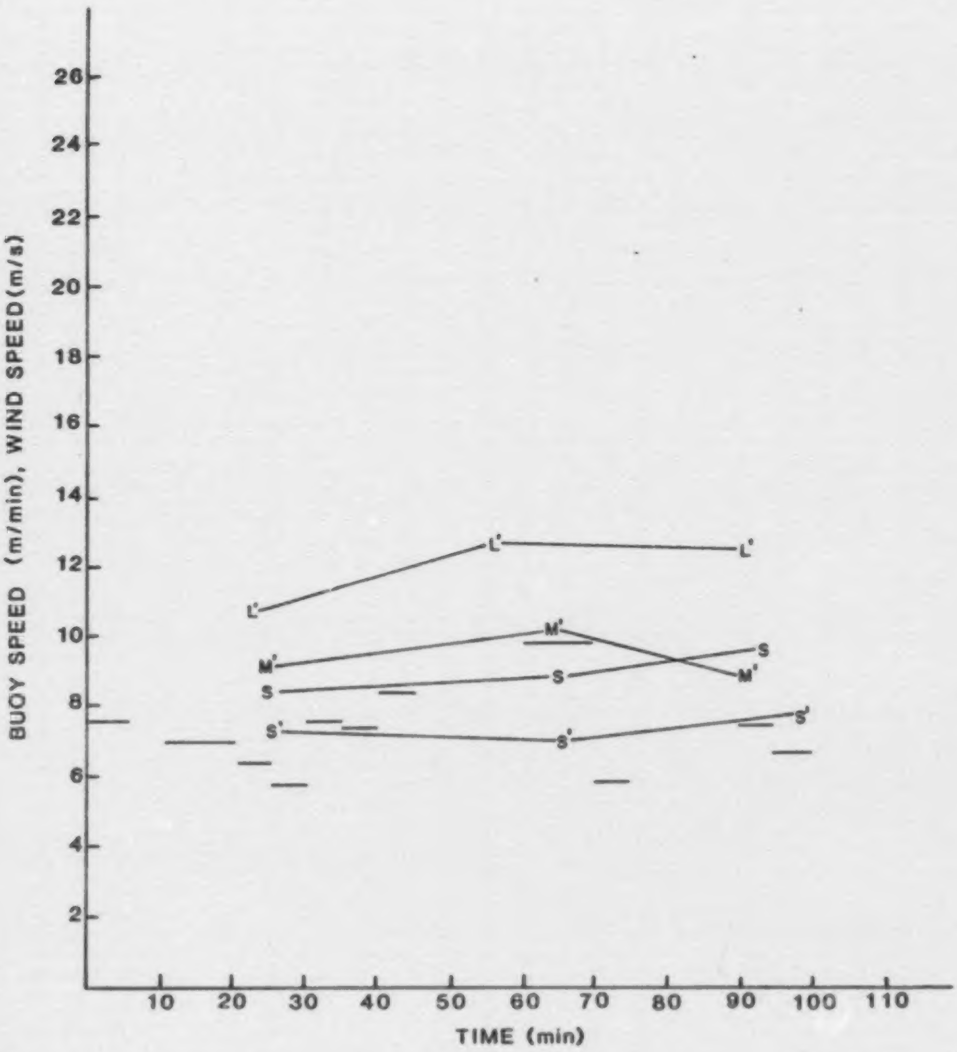
FIGURE B-125


BEDFORD BASIN
LAUNCH
WIND 40° T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO SMALL MAST 10 kg
STATIONS: PRINCE, ED
MEAN BUOY SPEED: 8.8 m/min
MEAN WIND SPEED: 7.4 m/s

TRIAL: 27
DATE: OCT 7/82 am
0925-1117

FIGURE B-126

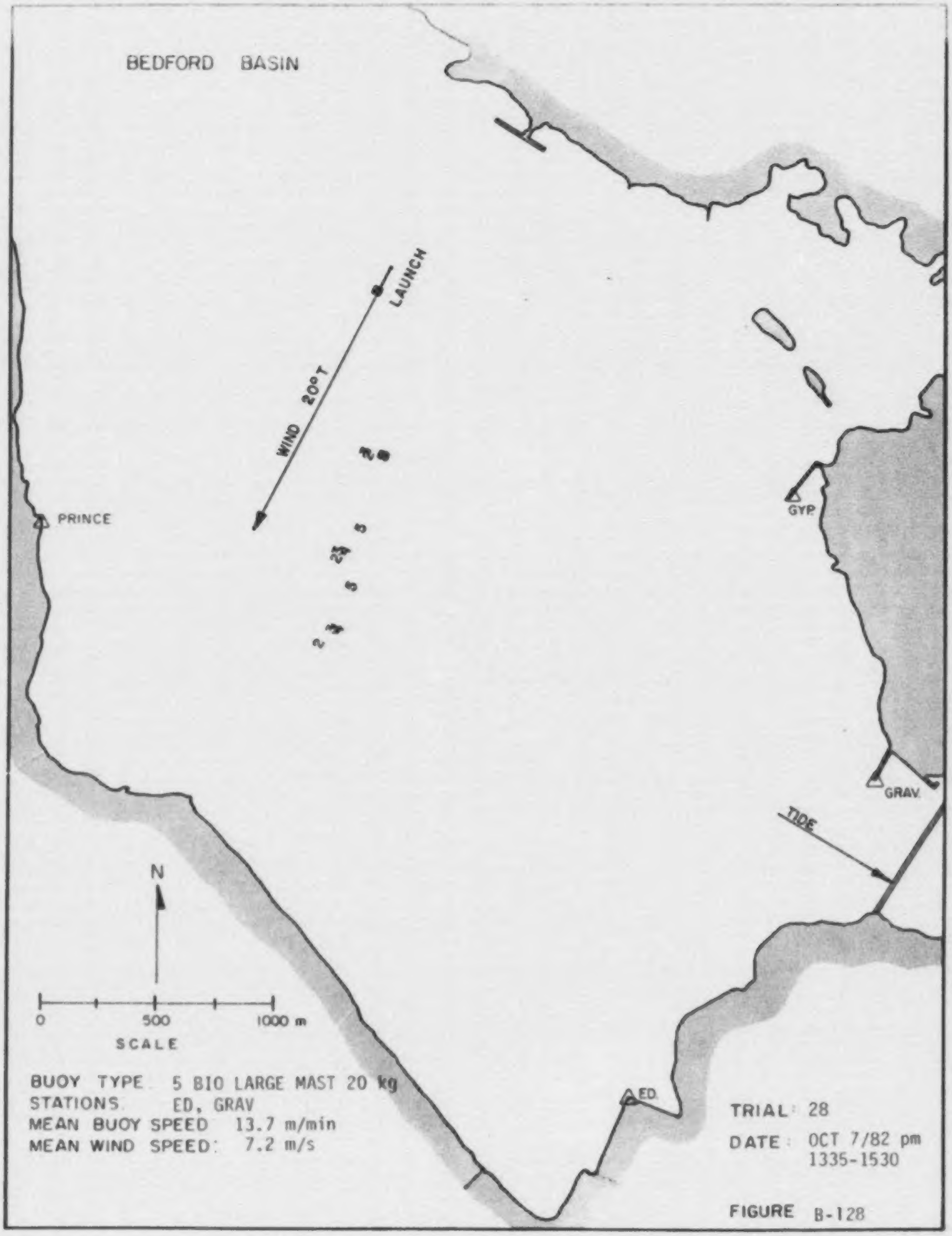


BUOY SPEED (ABSOLUTE ,AT
TIME BETWEEN FIXES) Vs TIME (ELAPSED)

LEGEND

L' - BIO LARGE MAST 20 kg
M' - BIO MED. MAST 20 kg
S' - BIO SMALL MAST 20 kg
S - BIO SMALL MAST 10 kg
— — WIND

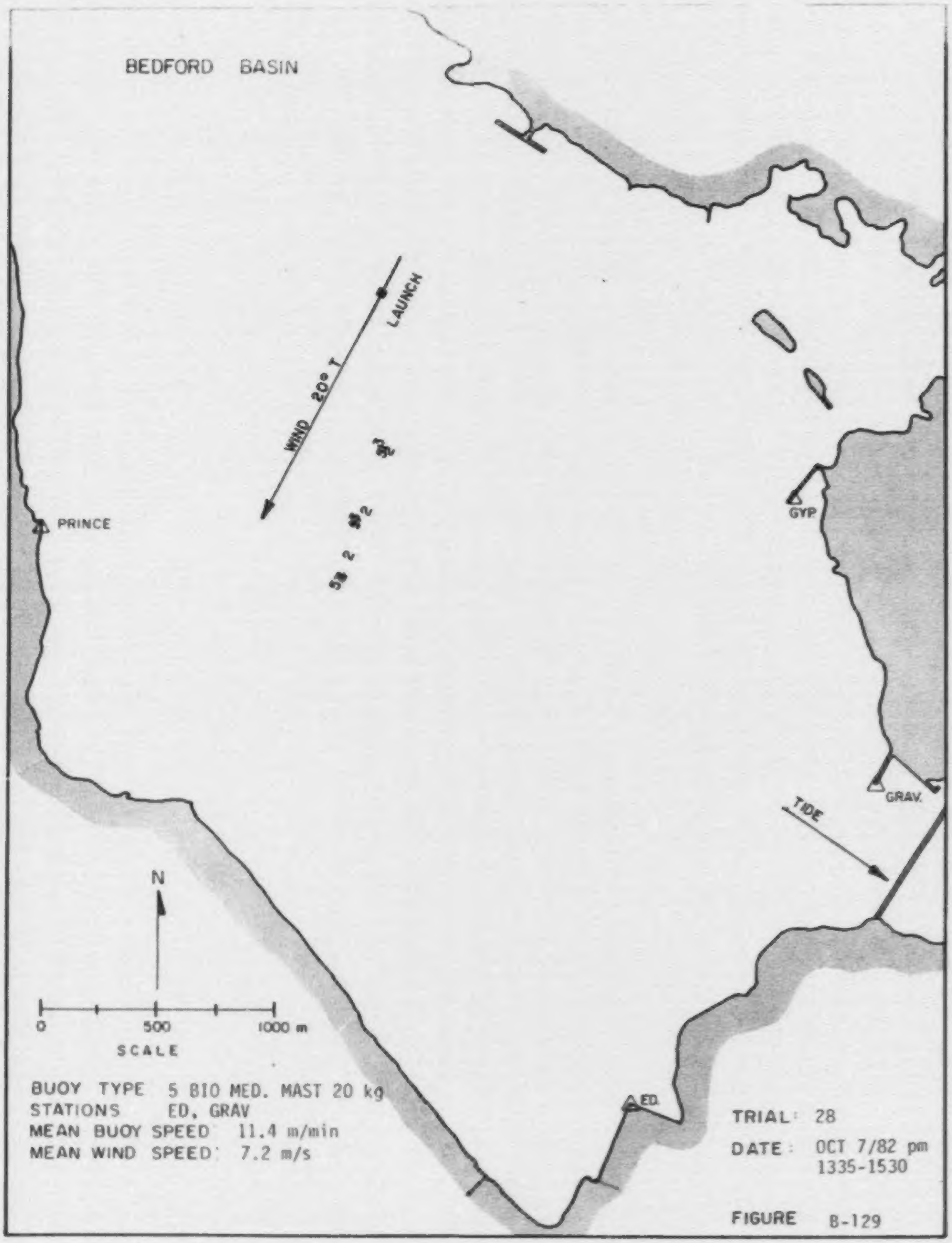
TRIAL : 27
DATE : OCT 7/82, 0925-1117
TIDE : HI - 1025
LOW - 1750
AV. WIND SPEED : 7.4 m/s
FIGURE : B-127


BEDFORD BASIN
LAUNCH
WIND 20°T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE 5 BIO LARGE MAST 20 kg
STATIONS ED, GRAV
MEAN BUOY SPEED 13.7 m/min
MEAN WIND SPEED: 7.2 m/s

TRIAL: 28
DATE: OCT 7/82 pm
1335-1530

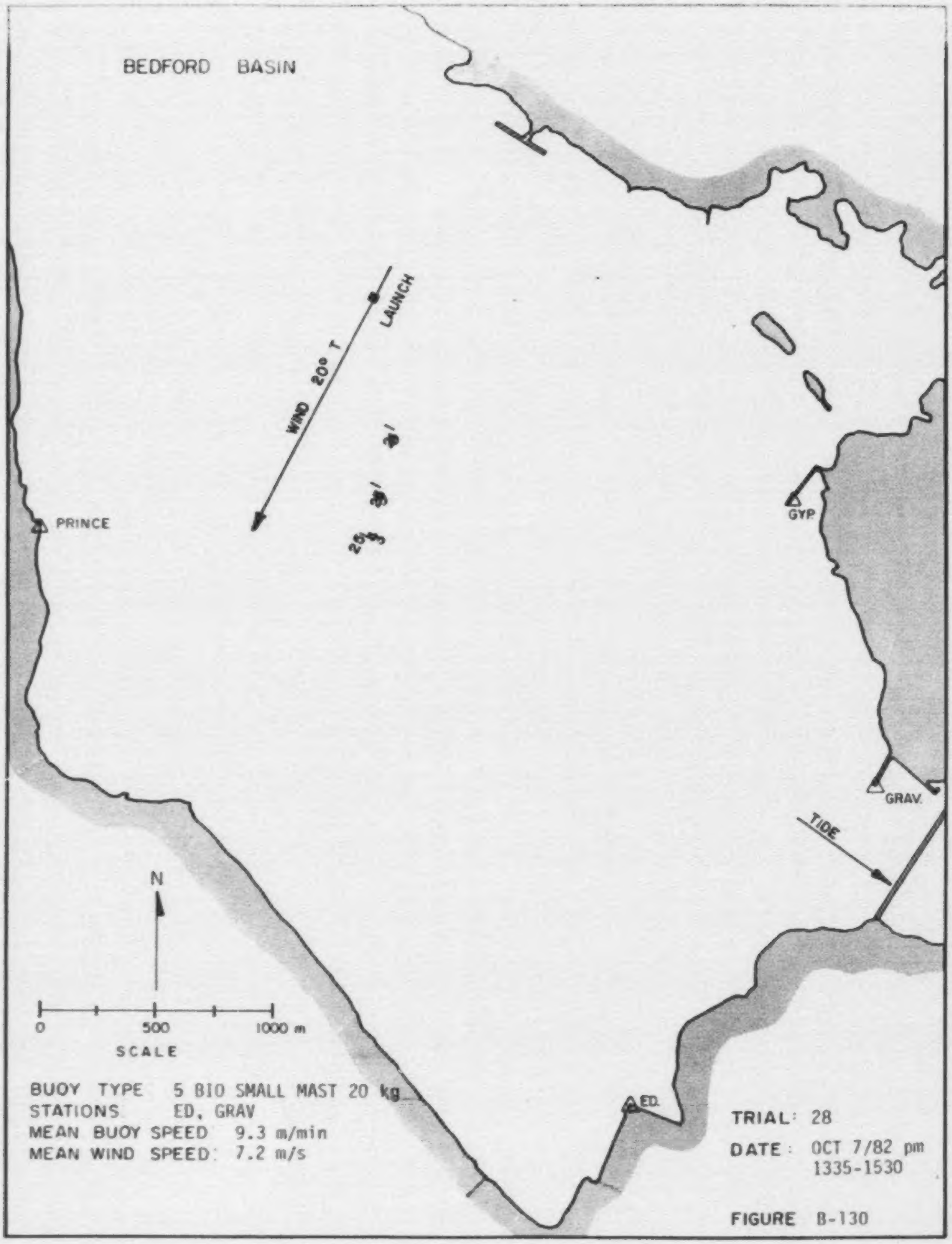
FIGURE B-128


BEDFORD BASIN
LAUNCH
WIND 20° T
PRINCE
GYP
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE 5 BIO MED. MAST 20 kg
STATIONS ED, GRAV
MEAN BUOY SPEED 11.4 m/min
MEAN WIND SPEED 7.2 m/s

TRIAL: 28
DATE: OCT 7/82 pm
1335-1530

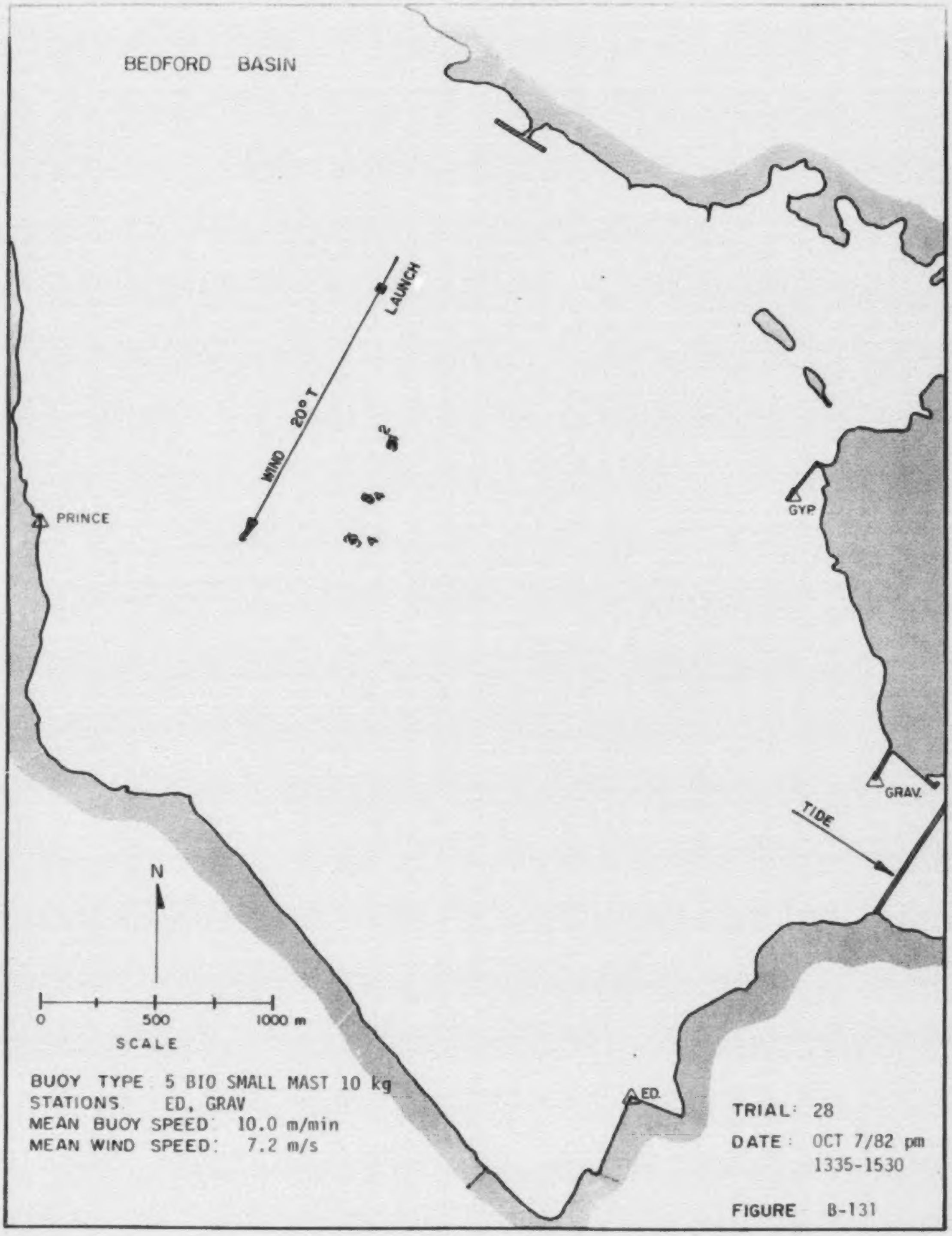
FIGURE B-129


BEDFORD BASIN
LAUNCH
WIND 20° T
PRINCE
GYP
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE 5 BIO SMALL MAST 20 kg
STATIONS ED, GRAV
MEAN BUOY SPEED 9.3 m/min
MEAN WIND SPEED: 7.2 m/s

TRIAL: 28
DATE: OCT 7/82 pm
1335-1530

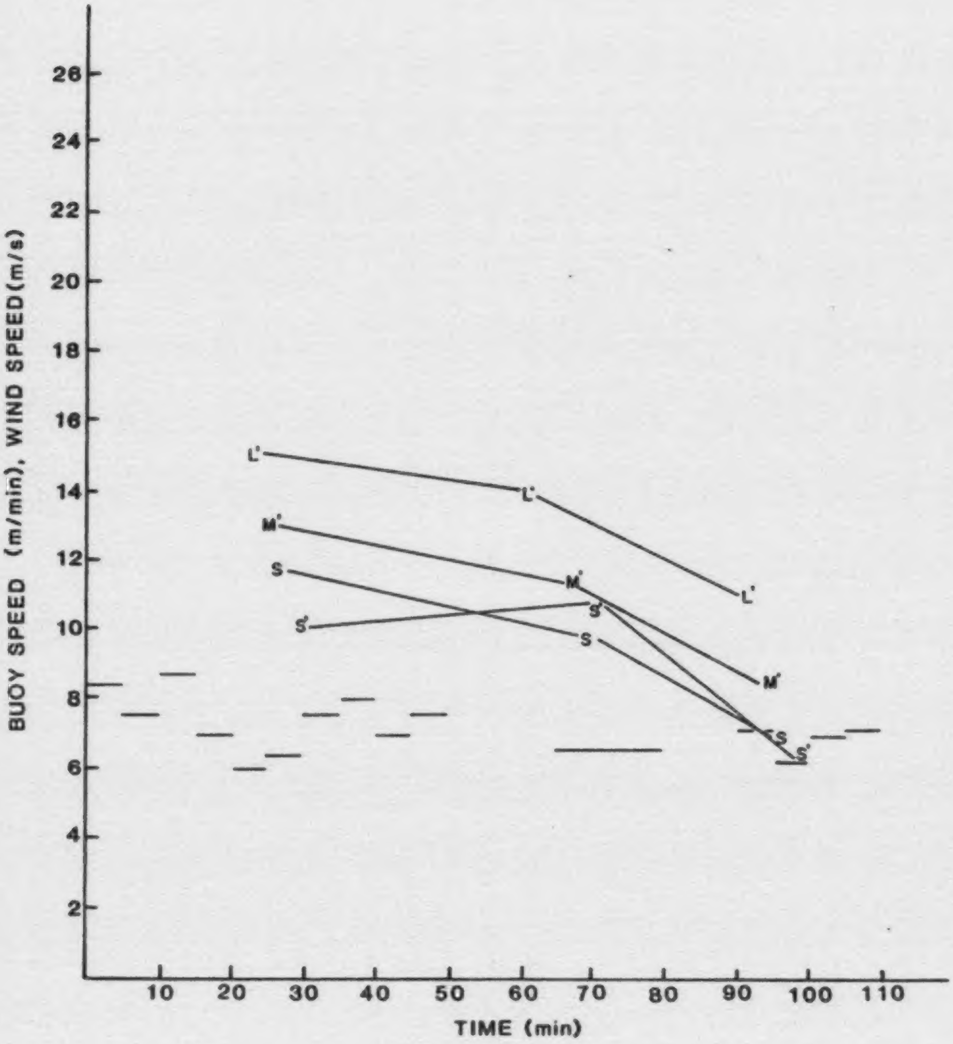
FIGURE B-130


BEDFORD BASIN
LAUNCH
WIND 20° T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE 5 BIO SMALL MAST 10 kg
STATIONS ED, GRAV
MEAN BUOY SPEED: 10.0 m/min
MEAN WIND SPEED: 7.2 m/s

TRIAL: 28
DATE: OCT 7/82 pm
1335-1530

FIGURE B-131



BUOY SPEED (ABSOLUTE ,AT
TIME BETWEEN FIXES) Vs TIME (ELAPSED)

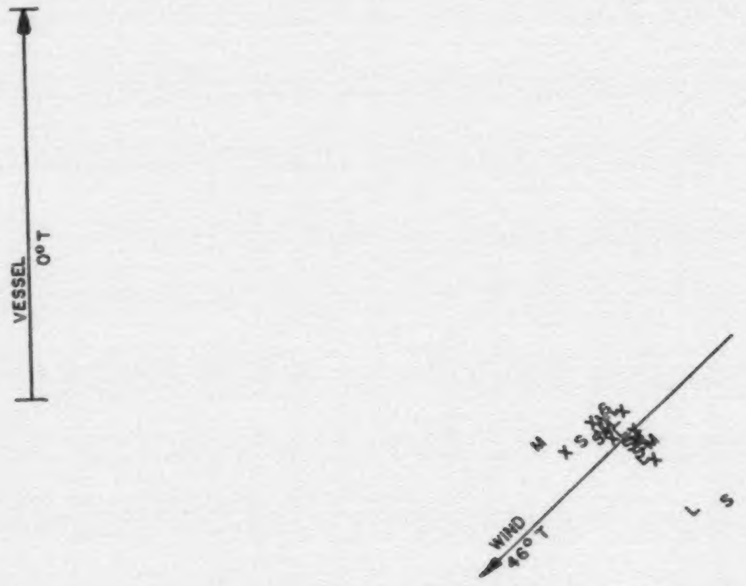
LEGEND

L' - BIO LARGE MAST 20 kg
M' - BIO MED. MAST 20 kg
S' - BIO SMALL MAST 20 kg
S - BIO SMALL MAST 10 kg
— — WIND

TRIAL : 28
DATE : OCT 7/82, 1335-1530
TIDE : HI - 1035
LOW - 1730

AV. WIND SPEED : 7.2 m/s

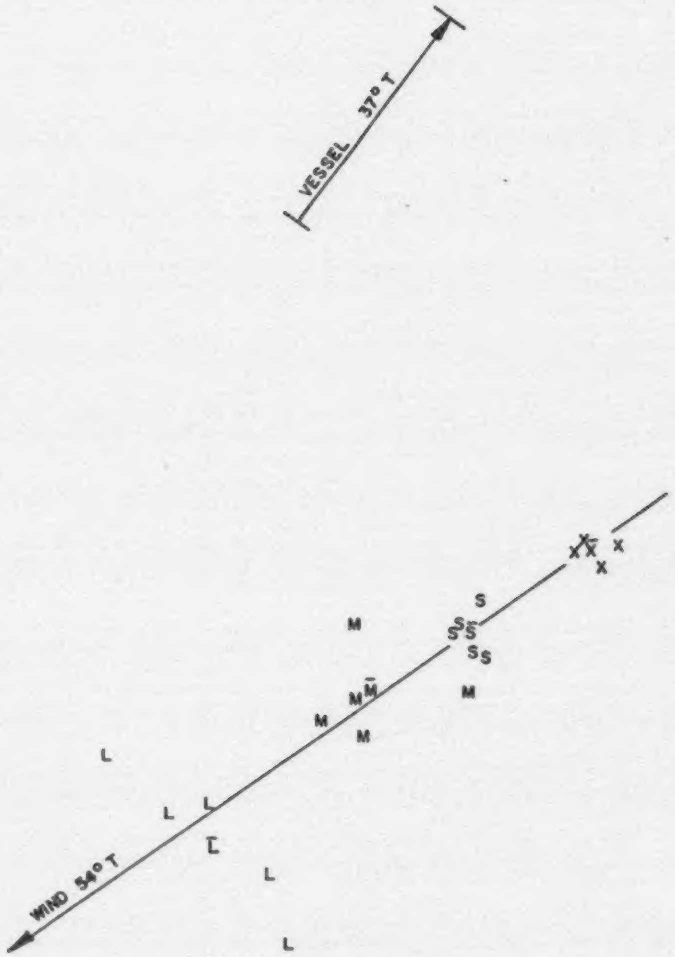
FIGURE : B-132


VESSEL
0°T
M
X S
L
S
WIND
46° T

RELATIVE BUOY SPEEDS
Xw.r.t.S : N/A
Lw.r.t.S : N/A   Mw.r.t.S: N/A
MEAN WIND SPEED : 6.5 m/s
SCALE : VESSEL 71.0 m LOA

LEGEND
X - NO MAST
S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

TRIAL : 29
0955-1150
DATE : NOV 18/82
TIME : T + 2 min
FIGURE : B-133



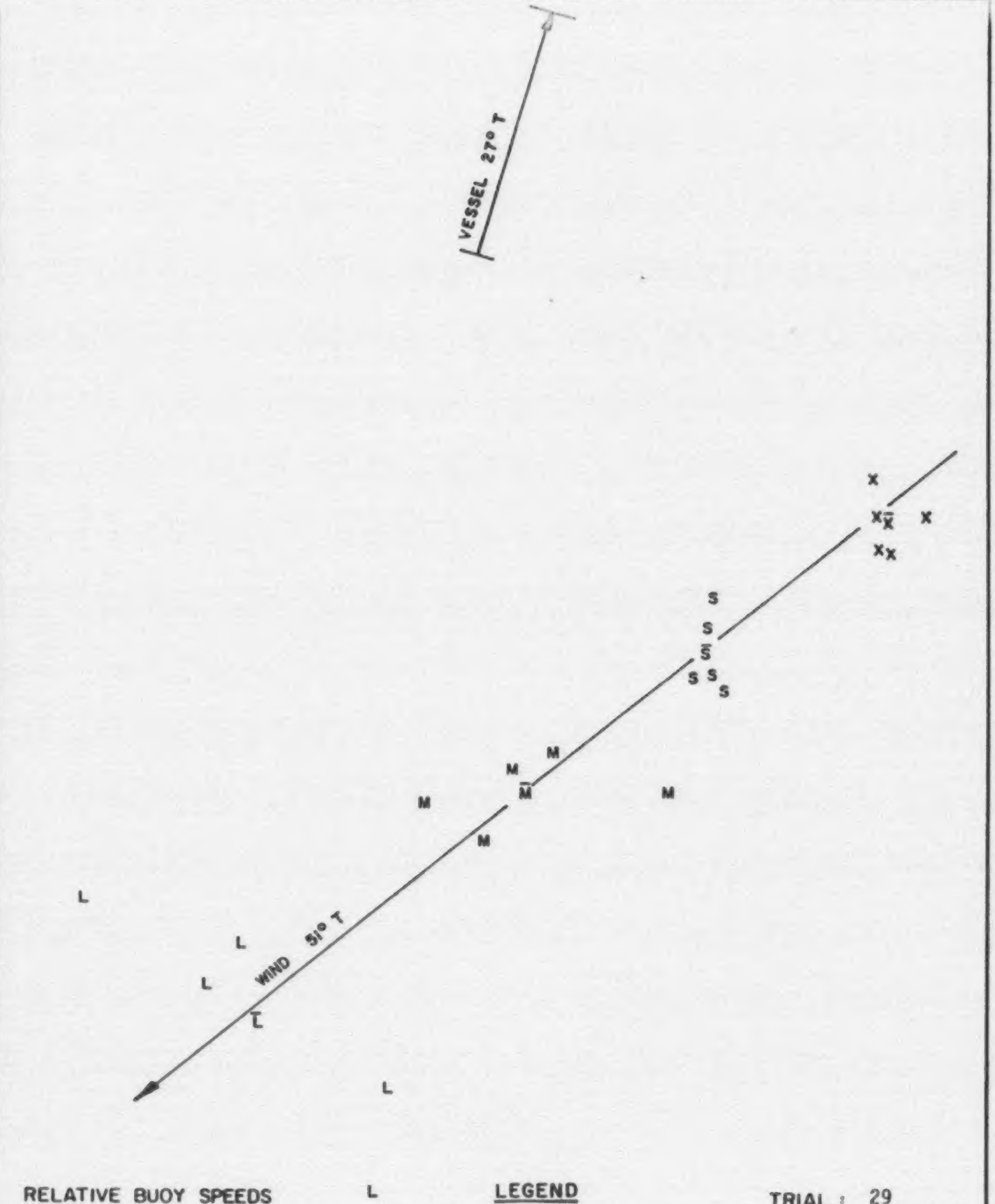
Note: The centre of mass $\bar{x}$ occupies the position of one of the x buoys.

RELATIVE BUOY SPEEDS
X w.r.t.S : 0.78 m/s
L w.r.t.S : 1.85 m/s
M w.r.t.S : 0.65 m/s
MEAN WIND SPEED : 6.5 m/s
SCALE : VESSEL 71.0m LOA

minute ?

LEGEND
X - NO MAST
S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

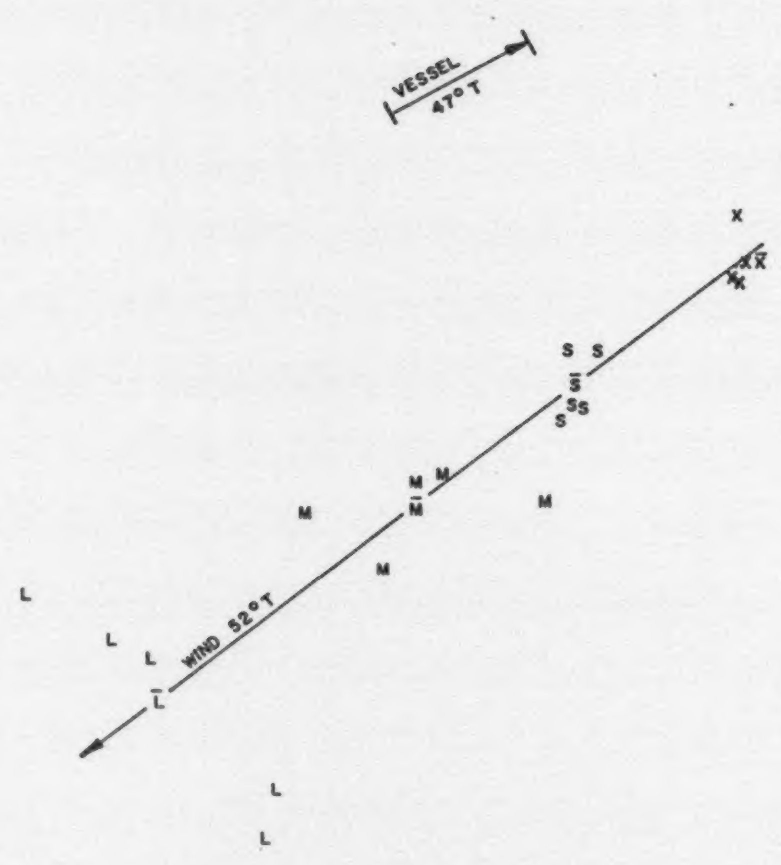
TRIAL : 29
0955-1150
DATE : NOV 18/82 am
TIME : T + 51 min
FIGURE : B-134



RELATIVE BUOY SPEEDS
X w.r.t S : 0.71 m/min
L w.r.t S : 2.3 m/min
M w.r.t S : 1.0 m/min
MEAN WIND SPEED : 6.5 m/s
SCALE : VESSEL 71.0 m LOA

LEGEND
X - NO MAST
S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

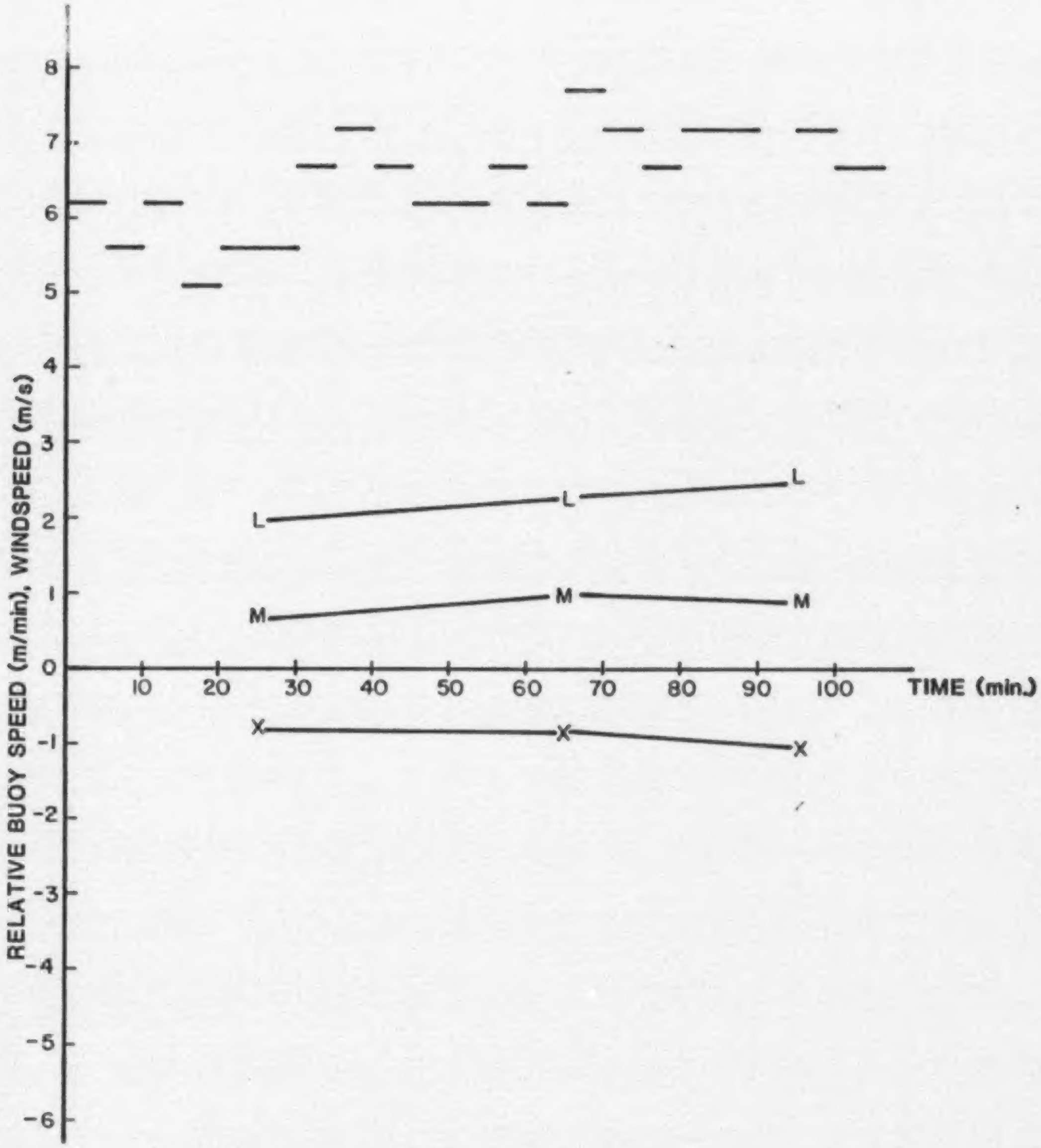
TRIAL : 29
0955-1150
DATE : NOV 18/81 am
TIME : T + 82 min
FIGURE : B-135



RELATIVE BUOY SPEEDS
X w.r.t.S : 1.04 m/min
L w.r.t.S : 2.47 m/min
M w.r.t.S: 0.89 m/min
MEAN WIND SPEED : 6.5 m/s
SCALE : VESSEL 71.0 m LOA

LEGEND
X - NO MAST
S - SMALL MAST
M - MEDIUM MAST
L - LARGE MAST

TRIAL : 29
0955-1150
DATE : NOV 18/82 am
TIME : T + 114 min
FIGURE : B-136



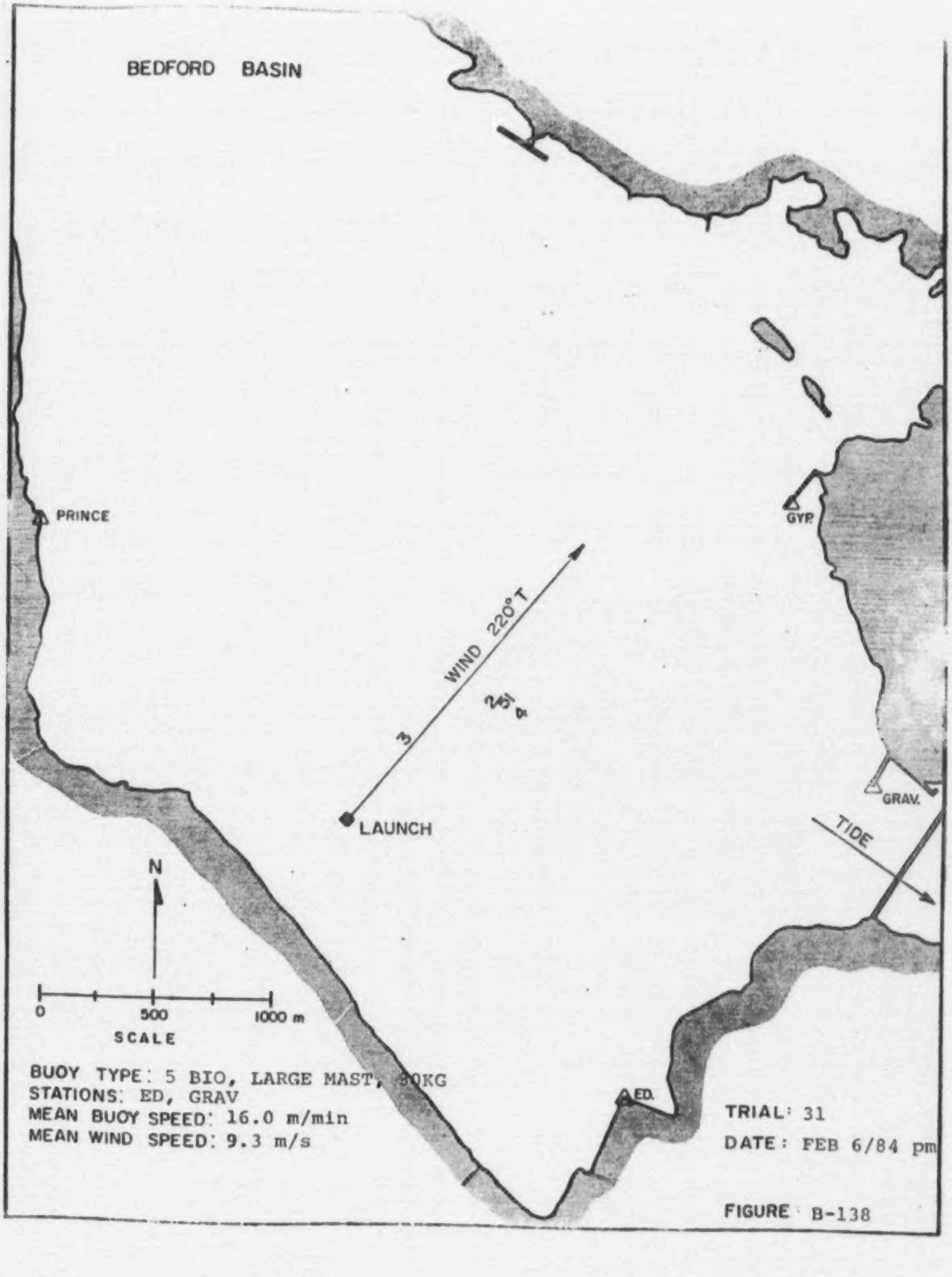
BUOY SPEED (RELATIVE, AT TIME BETWEEN FIXES)

Vs TIME (ELAPSED)

LEGEND

L - BIO LARGE MAST
M - BIO MED. MAST
X - BIO NO MAST
— — WIND

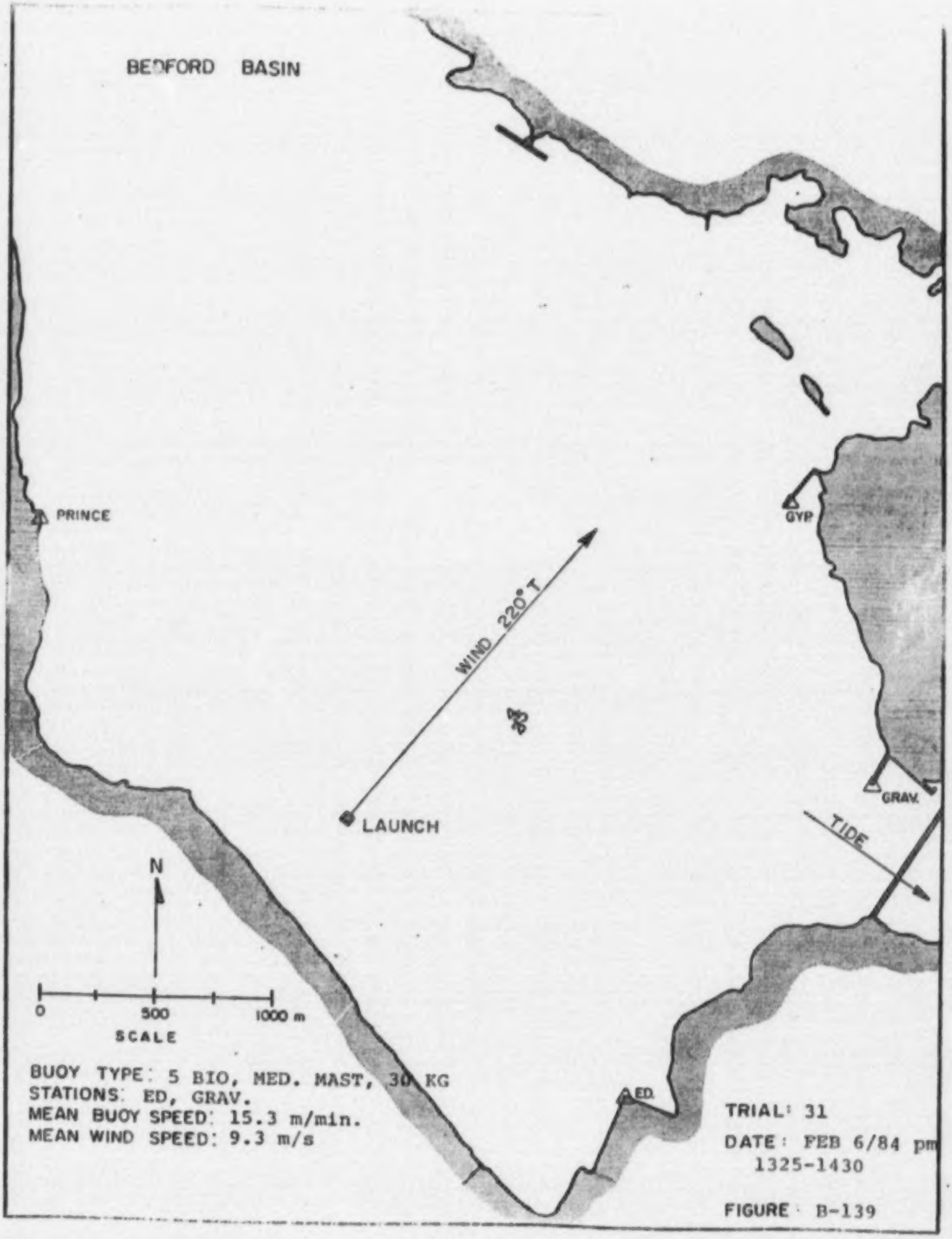
TRIAL: 29
DATE: NOV 18/82, 0955-1150
TIDE: HI - 0925, LOW - 1555
AV. WIND SPEED: 6.5 m/s
FIGURE: B-137


BEDFORD BASIN
PRINCE
GYP.
GRAV.
ED.
TIDE
LAUNCH
WIND 220° T
3
2
5
1
4
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, LARGE MAST, 30KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 16.0 m/min
MEAN WIND SPEED: 9.3 m/s

TRIAL: 31
DATE: FEB 6/84 pm

FIGURE B-138

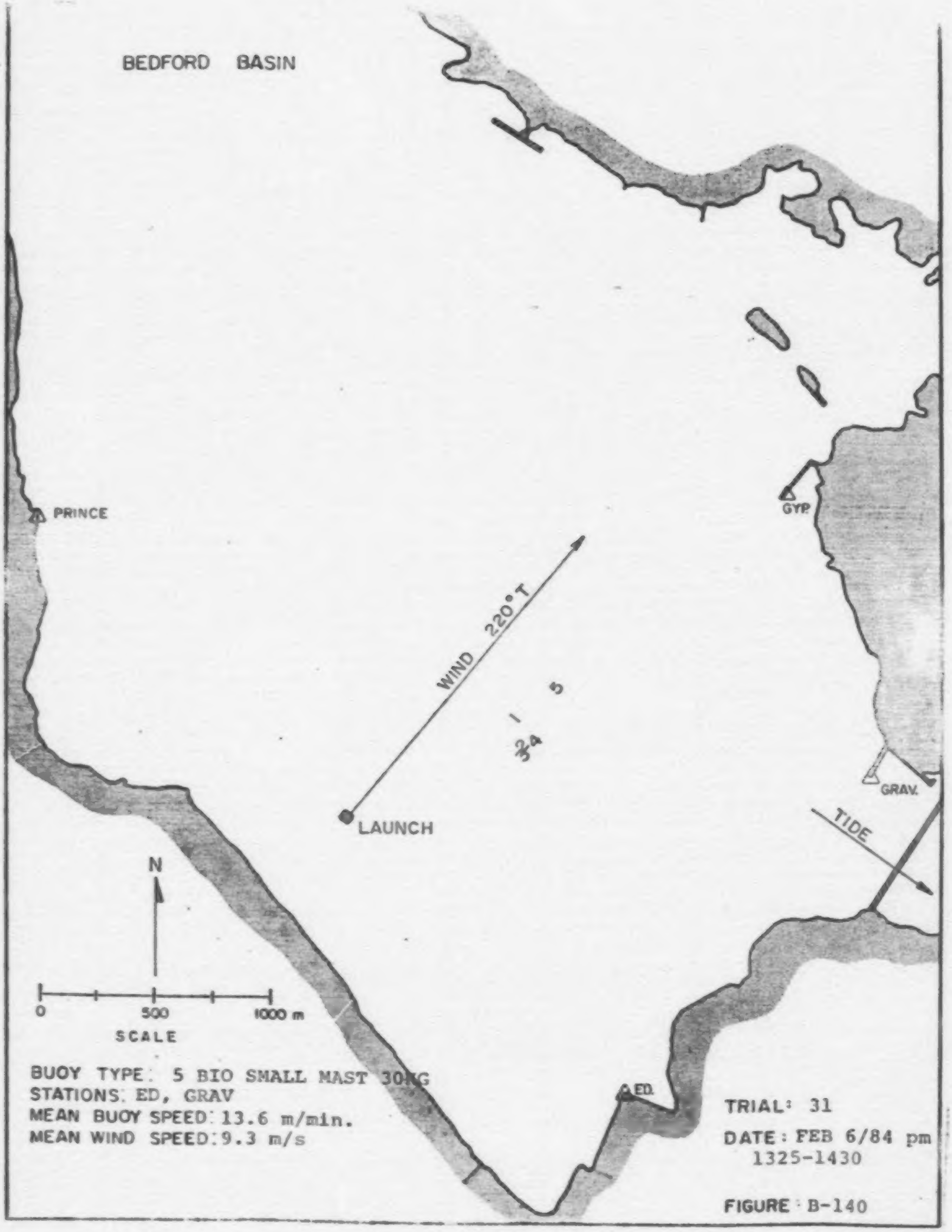

BEDFORD BASIN
PRINCE
GYP
GRAV.
ED.
LAUNCH
WIND 220° T
TIDE
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, MED. MAST, 30 KG
STATIONS: ED, GRAV.
MEAN BUOY SPEED: 15.3 m/min.
MEAN WIND SPEED: 9.3 m/s

TRIAL: 31

DATE: FEB 6/84 pm
1325-1430

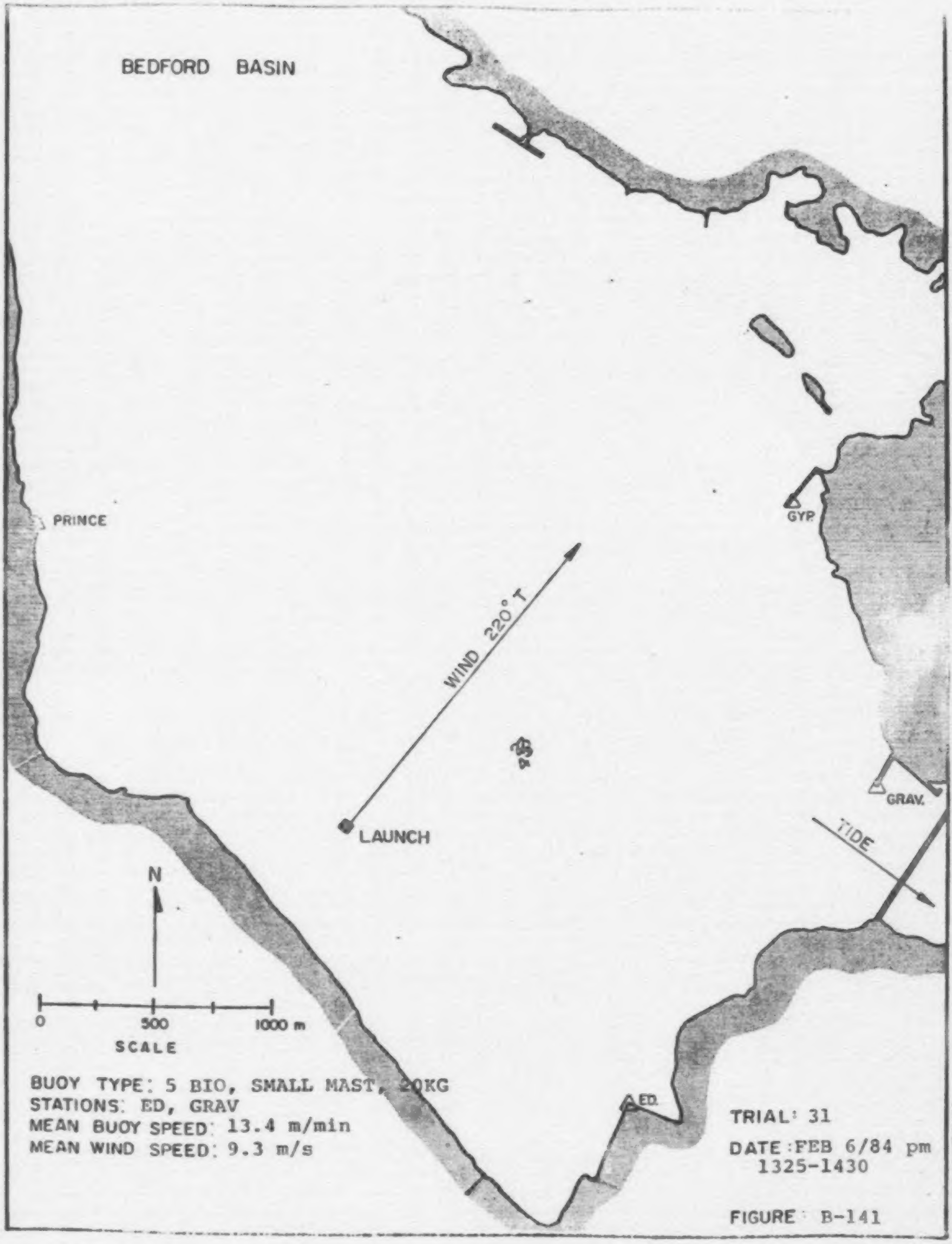
FIGURE B-139


BEDFORD BASIN
PRINCE
GYP.
GRAV.
ED.
WIND 220°T
1
5
2
3
4
LAUNCH
TIDE
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO SMALL MAST 30KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 13.6 m/min.
MEAN WIND SPEED: 9.3 m/s

TRIAL: 31
DATE: FEB 6/84 pm
1325-1430

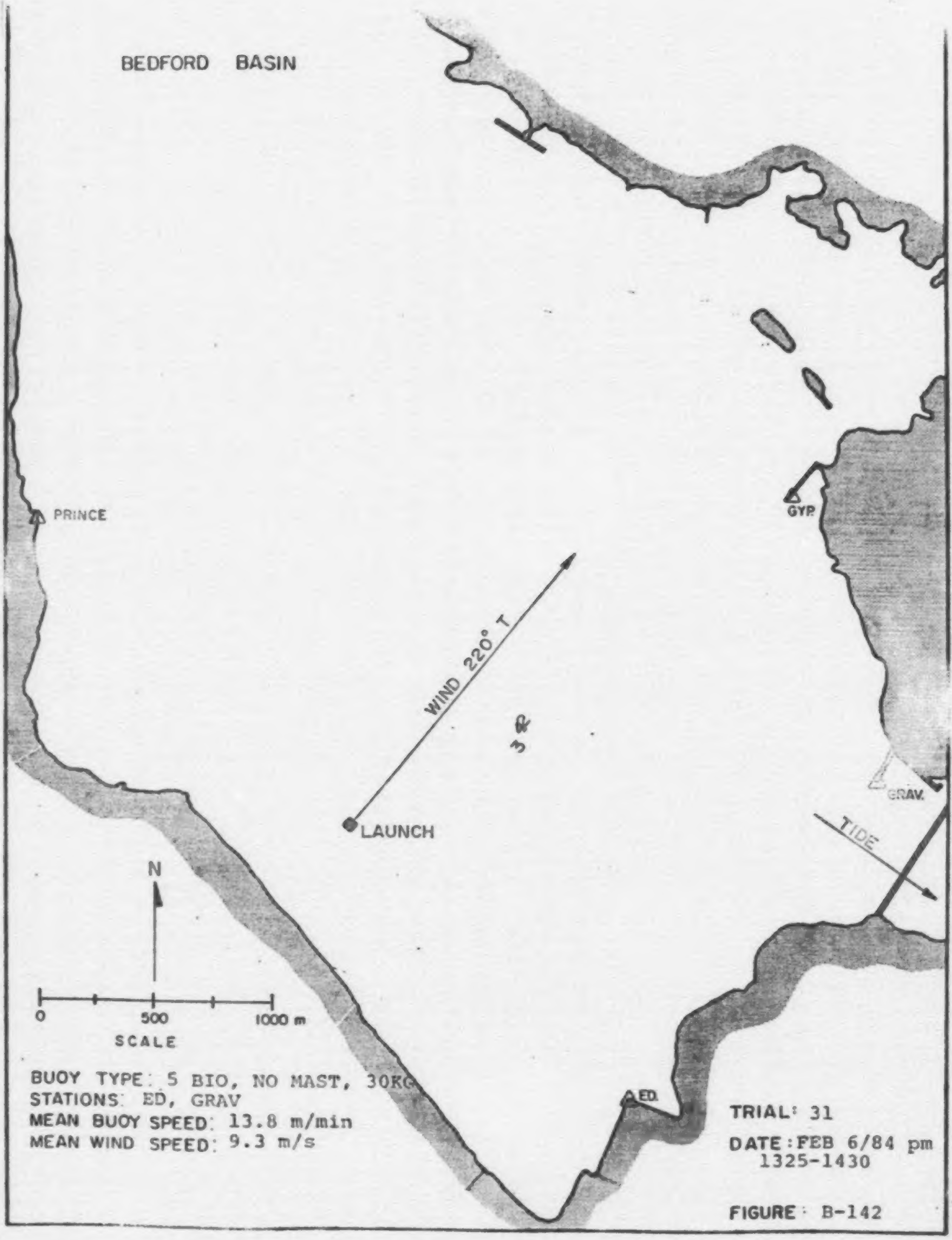
FIGURE B-140


BEDFORD BASIN
PRINCE
GYP.
WIND 220° T
LAUNCH
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, SMALL MAST, 20KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 13.4 m/min
MEAN WIND SPEED: 9.3 m/s

TRIAL: 31
DATE: FEB 6/84 pm
1325-1430

FIGURE: B-141

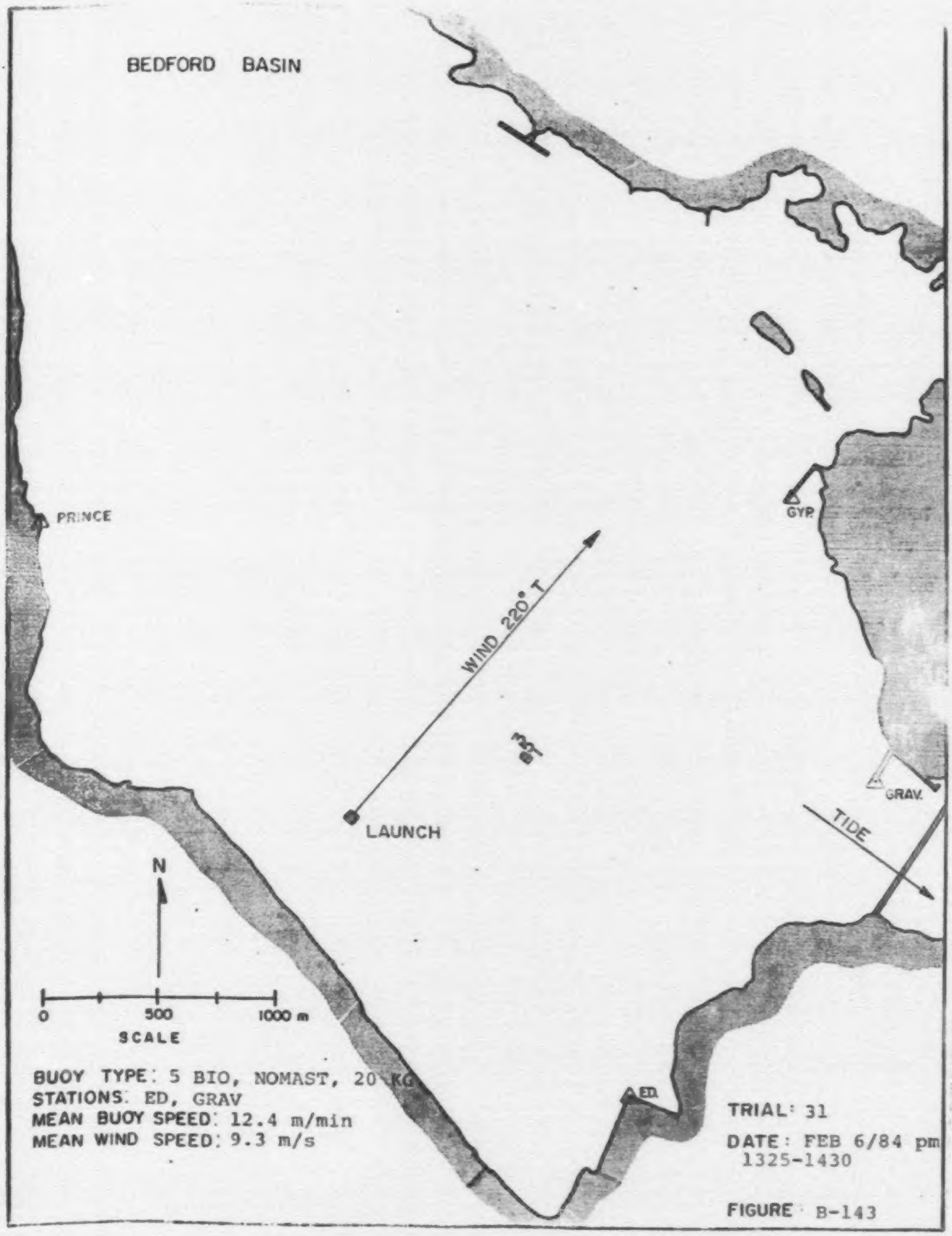

BEDFORD BASIN
PRINCE
GYP.
WIND 220° T
3 R
GRAV.
LAUNCH
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, NO MAST, 30KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 13.8 m/min
MEAN WIND SPEED: 9.3 m/s

TRIAL: 31

DATE: FEB 6/84 pm
1325-1430

FIGURE: B-142

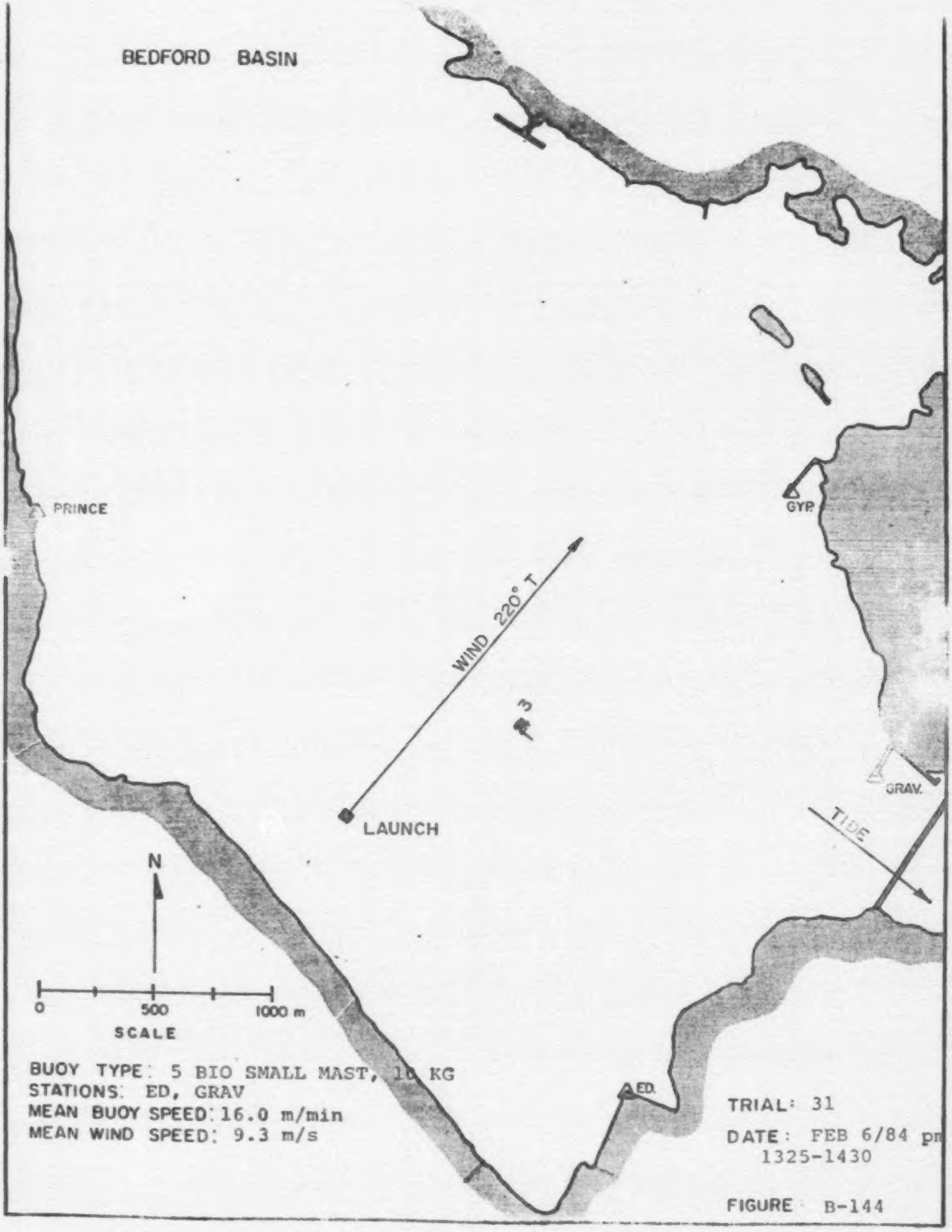

BEDFORD BASIN
PRINCE
GYP.
WIND 220° T
3
LAUNCH
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, NOMAST, 20 KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 12.4 m/min
MEAN WIND SPEED: 9.3 m/s

TRIAL: 31

DATE: FEB 6/84 pm
1325-1430

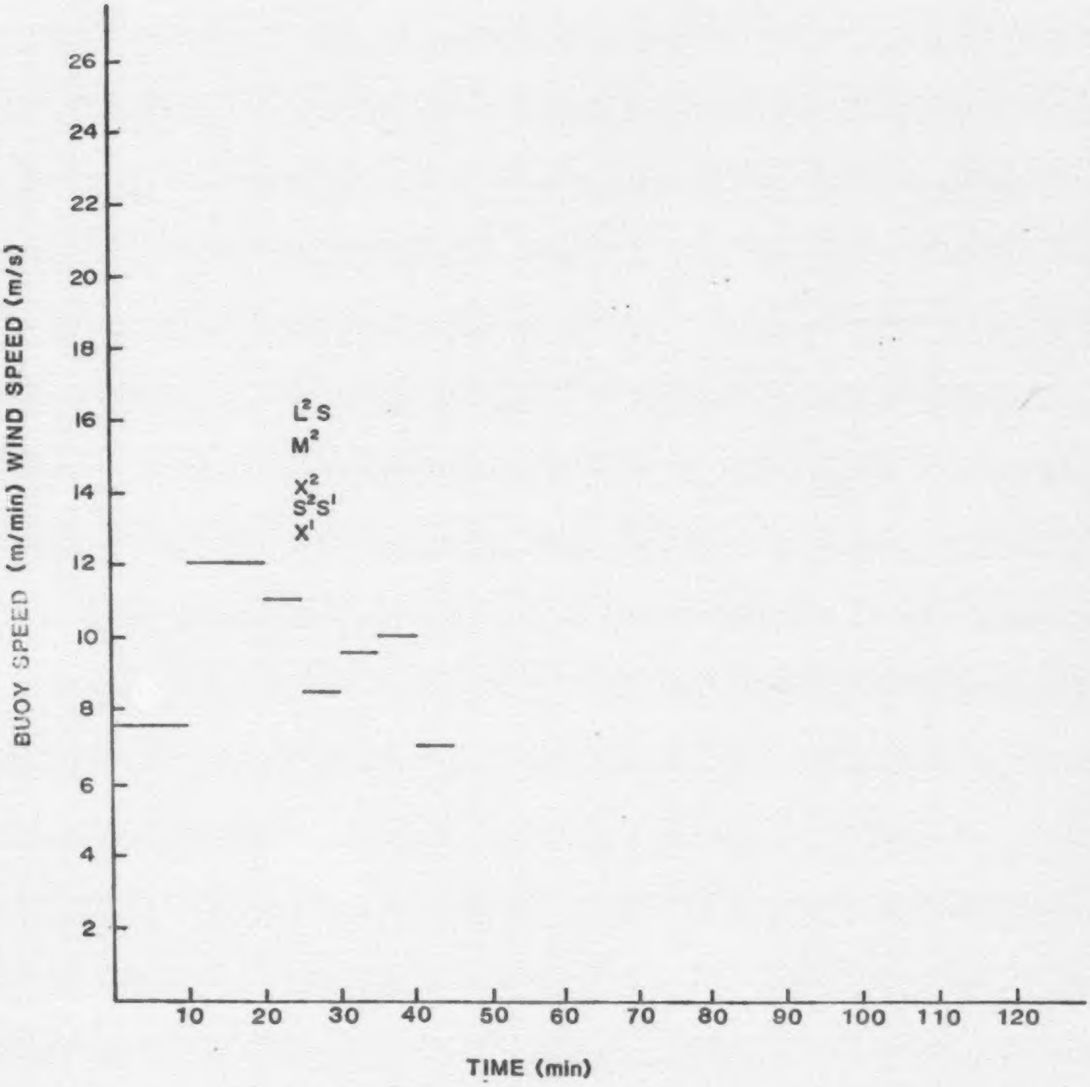
FIGURE B-143


BEDFORD BASIN
PRINCE
GYP.
GRAV.
ED.
WIND 220° T
3
LAUNCH
TIDE
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO SMALL MAST, 10 KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 16.0 m/min
MEAN WIND SPEED: 9.3 m/s

TRIAL: 31
DATE: FEB 6/84 pm
1325-1430

FIGURE B-144



BUOY SPEED (ABSOLUTE, AT
TIME BETWEEN FIXES) Vs TIME (ELAPSED)

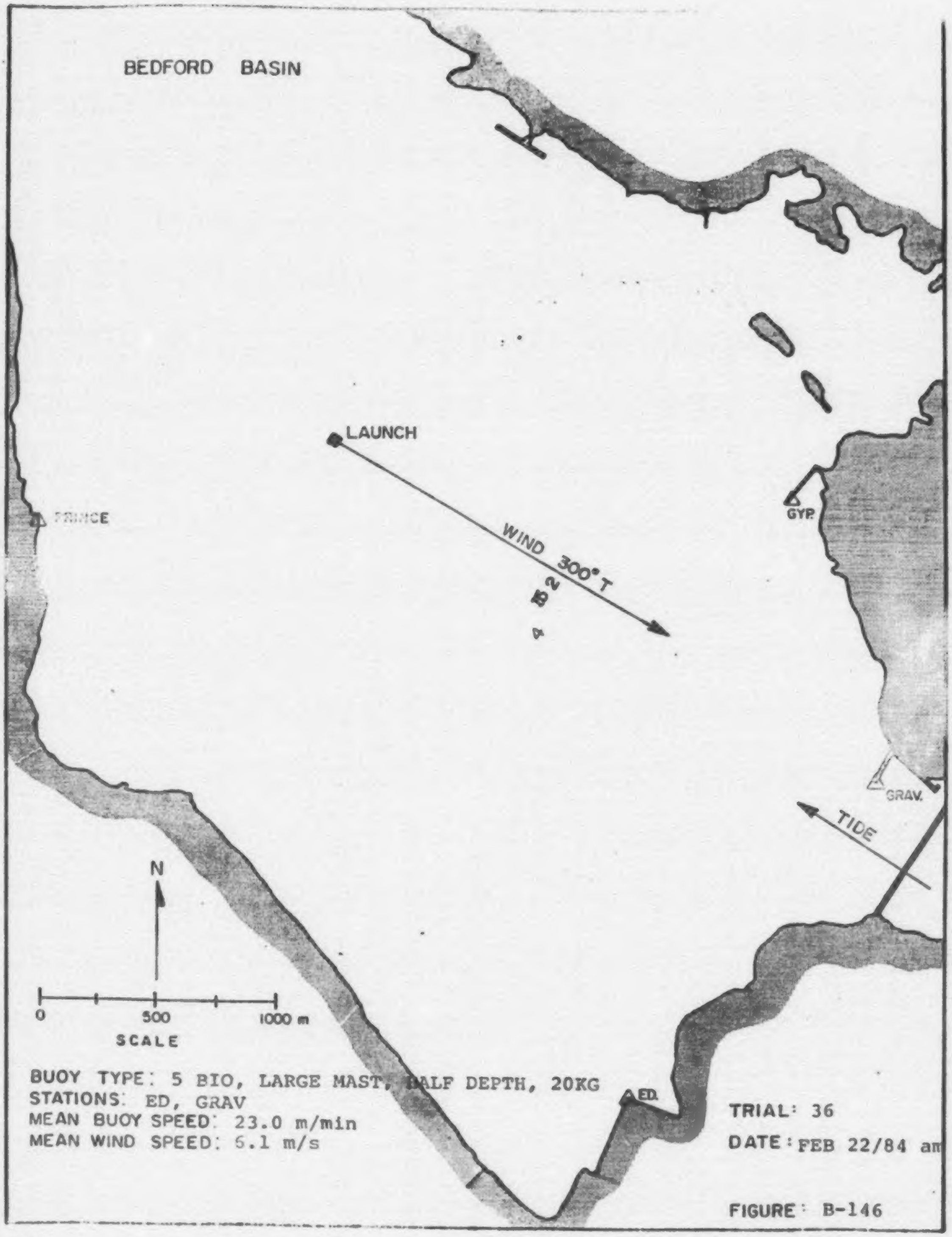
LEGEND

L^2-BIO LARGE MAST, 30KG
M^2-BIO MED. MAST, 30KG
S^2-BIO SMALL MAST, 30KG
X^2-BIO NO MAST, 30KG
X^1-BIO NO MAST, 20KG
S^1-BIO SMALL MAST, 20KG
S-BIO SMALL MAST, 10KG
---WIND

TRIAL : 31
DATE : FEB 6/84 pm
TIDE : HI - 1045
LOW - 1655

AV. WIND SPEED : 9.3 m/s

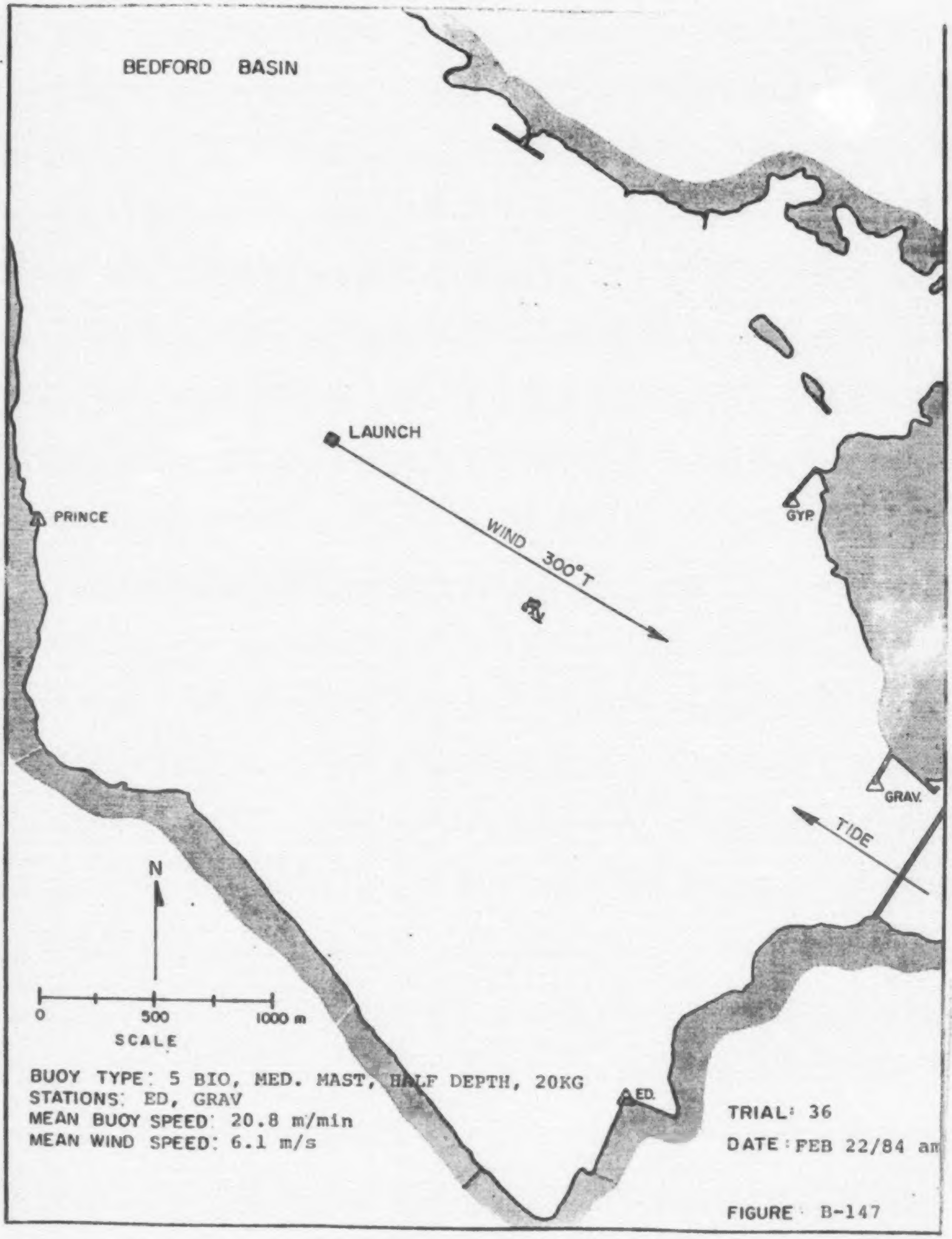
FIGURE : B-145


BEDFORD BASIN
LAUNCH
WIND 300°T
2
B
4
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, LARGE MAST, HALF DEPTH, 20KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 23.0 m/min
MEAN WIND SPEED: 6.1 m/s

TRIAL: 36
DATE: FEB 22/84 am

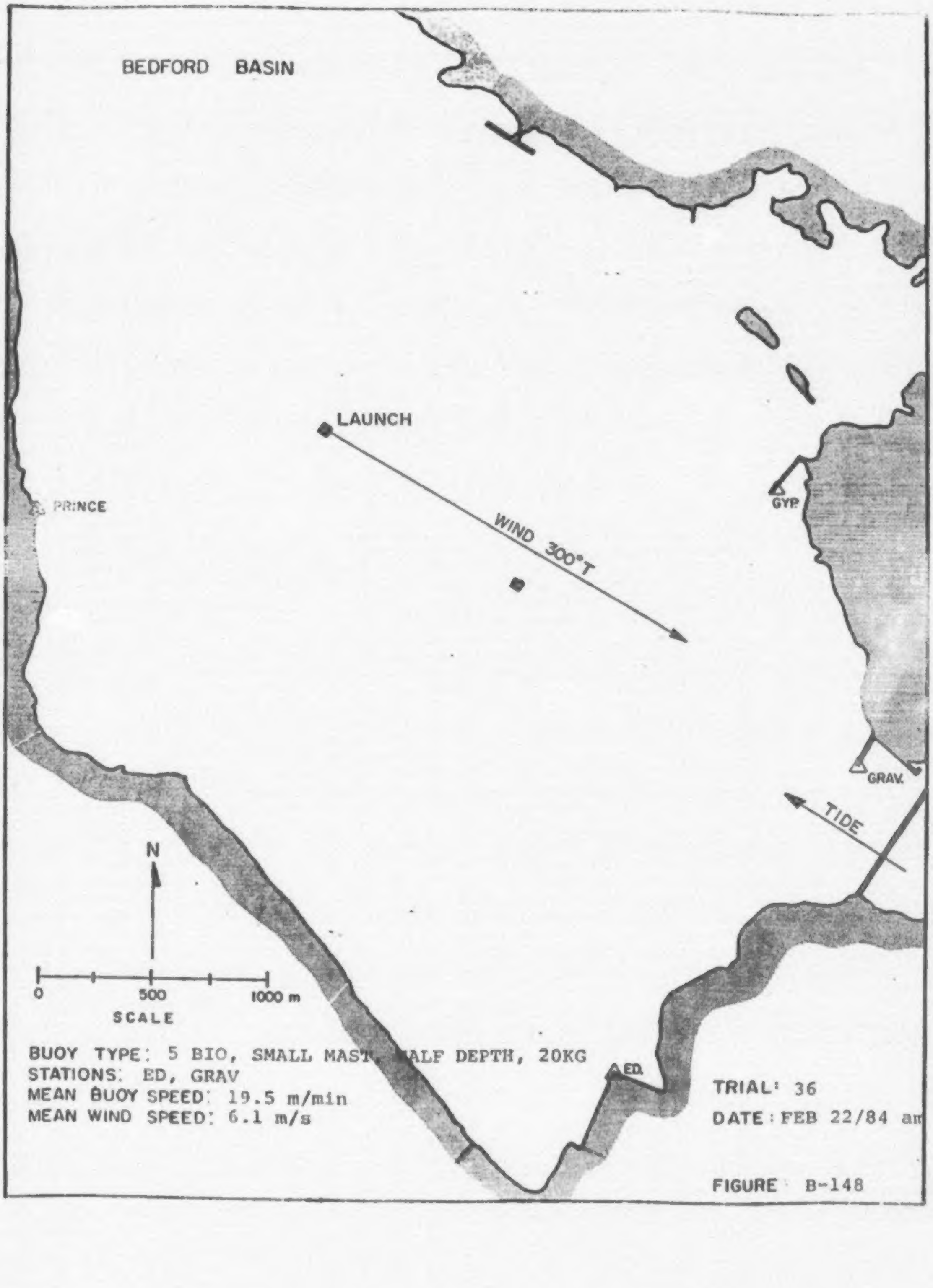
FIGURE: B-146


BEDFORD BASIN
LAUNCH
WIND 300°T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, MED. MAST, HALF DEPTH, 20KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 20.8 m/min
MEAN WIND SPEED: 6.1 m/s

TRIAL: 36
DATE: FEB 22/84 am

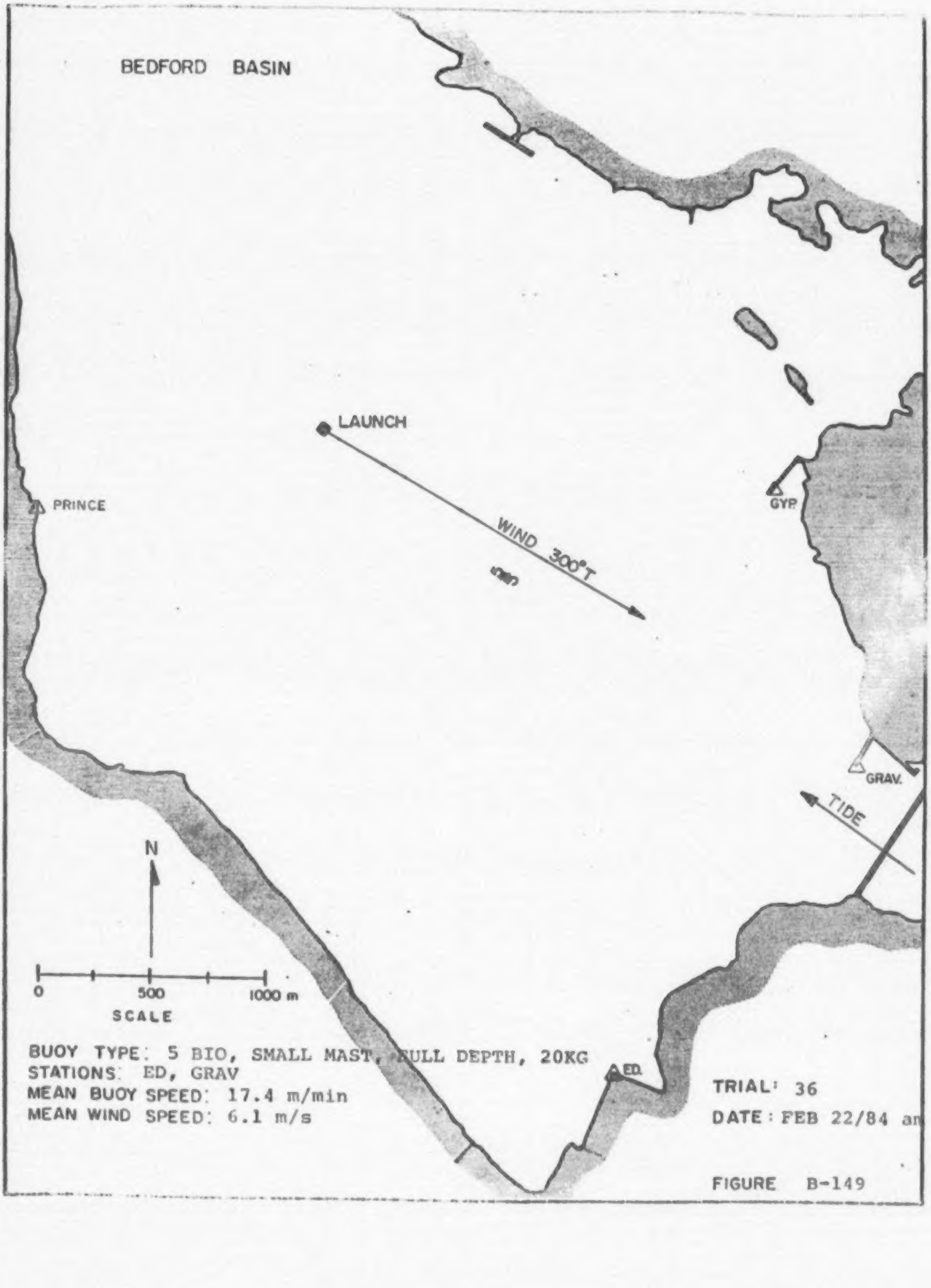
FIGURE B-147


BEDFORD BASIN
LAUNCH
WIND 300°T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, SMALL MAST, HALF DEPTH, 20KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 19.5 m/min
MEAN WIND SPEED: 6.1 m/s

TRIAL: 36
DATE: FEB 22/84 am

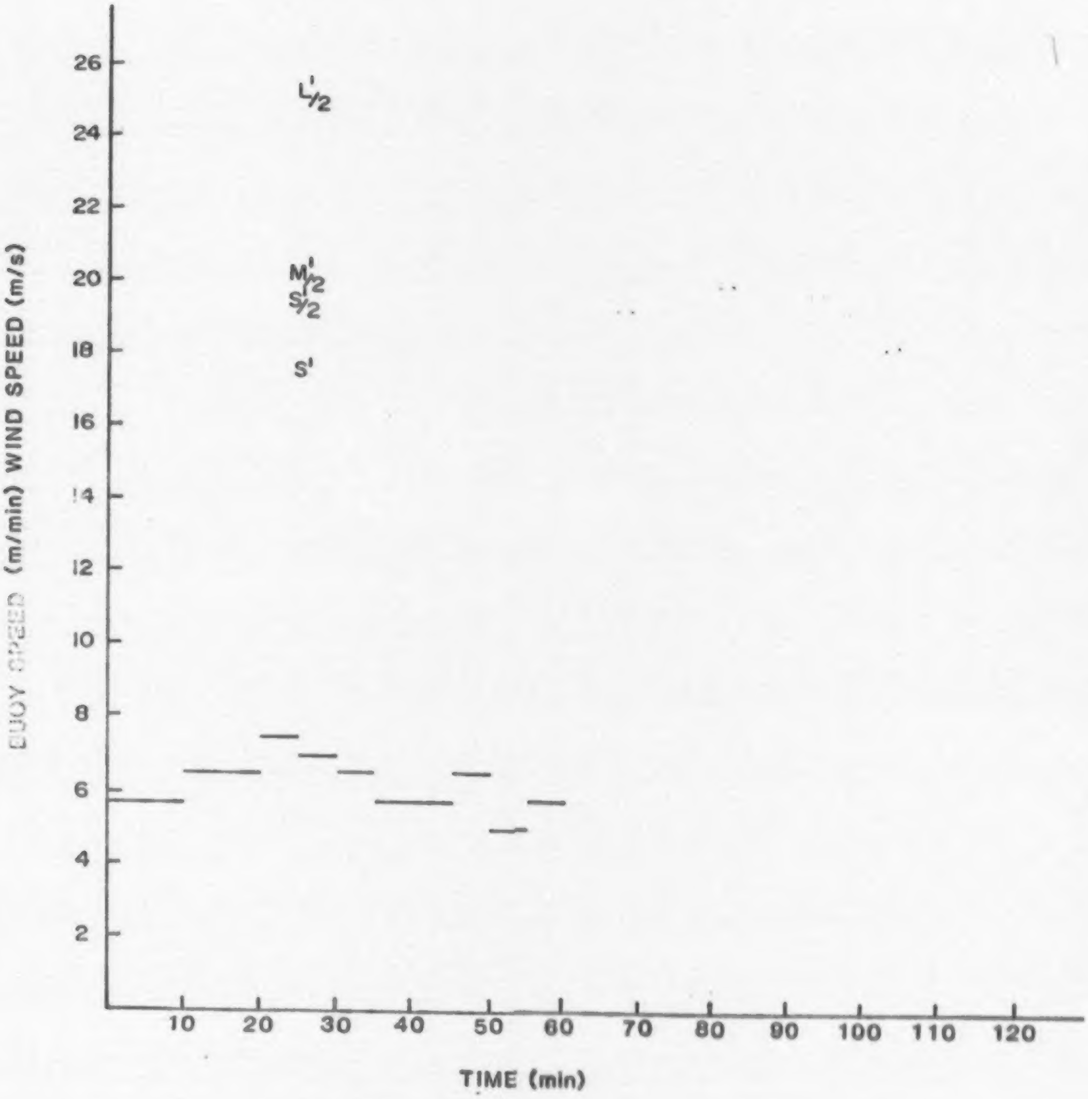
FIGURE B-148


BEDFORD BASIN
LAUNCH
WIND 300°T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, SMALL MAST, FULL DEPTH, 20KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 17.4 m/min
MEAN WIND SPEED: 6.1 m/s

TRIAL: 36
DATE: FEB 22/84 a

FIGURE B-149

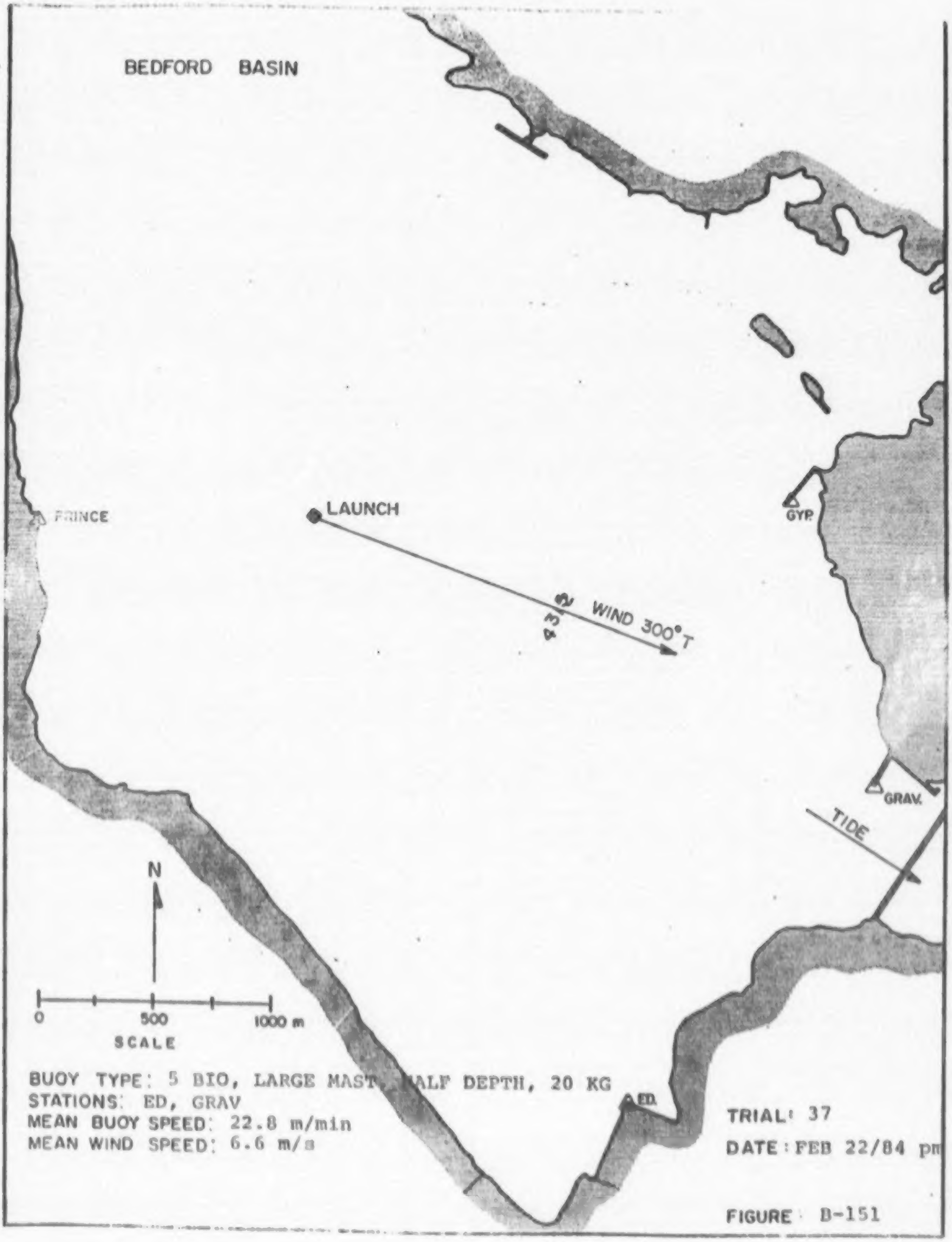


BUOY SPEED (ABSOLUTE, AT TIME BETWEEN FIXES) Vs TIME (ELAPSED)

LEGEND

$L'/_2$ - BIO LARGE MAST, HALF DEPTH, 20KG
$M'/_2$ - BIO MED. MAST, HALF DEPTH, 20KG
$S'/_2$ - BIO SMALL MAST, HALF DEPTH, 20KG
S' - BIO SMALL MAST, FULL DEPTH, 20KG
--- - WIND

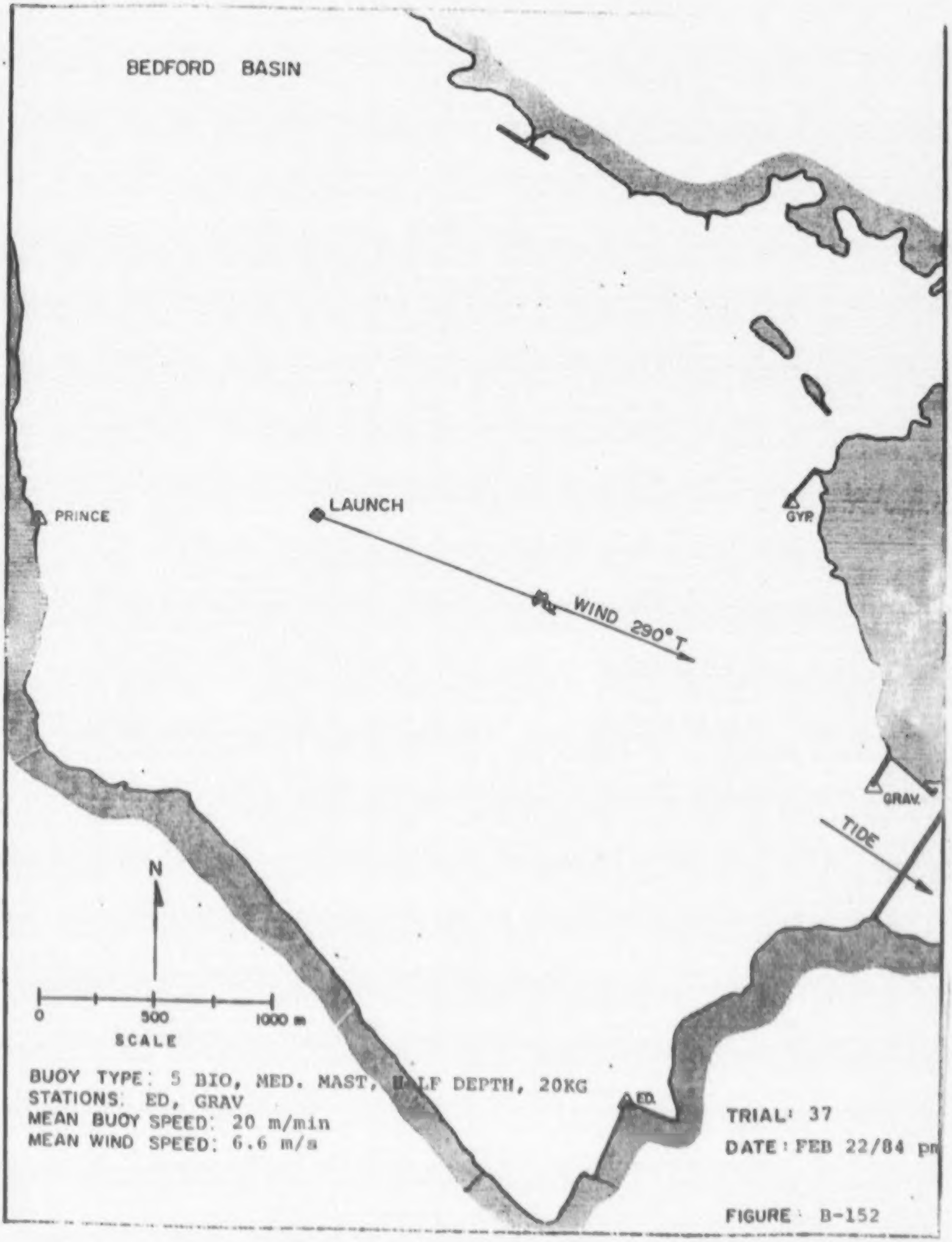
TRIAL : 36
DATE : FEB 22/84 am
TIDE : LOW - 0655
HI - 1200
AV. WIND SPEED : 6.1 m/s
FIGURE : B-150


BEDFORD BASIN
PRINCE
LAUNCH
GYP.
432
WIND 300°T
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, LARGE MAST, HALF DEPTH, 20 KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 22.8 m/min
MEAN WIND SPEED: 6.6 m/s

TRIAL: 37
DATE: FEB 22/84 pm

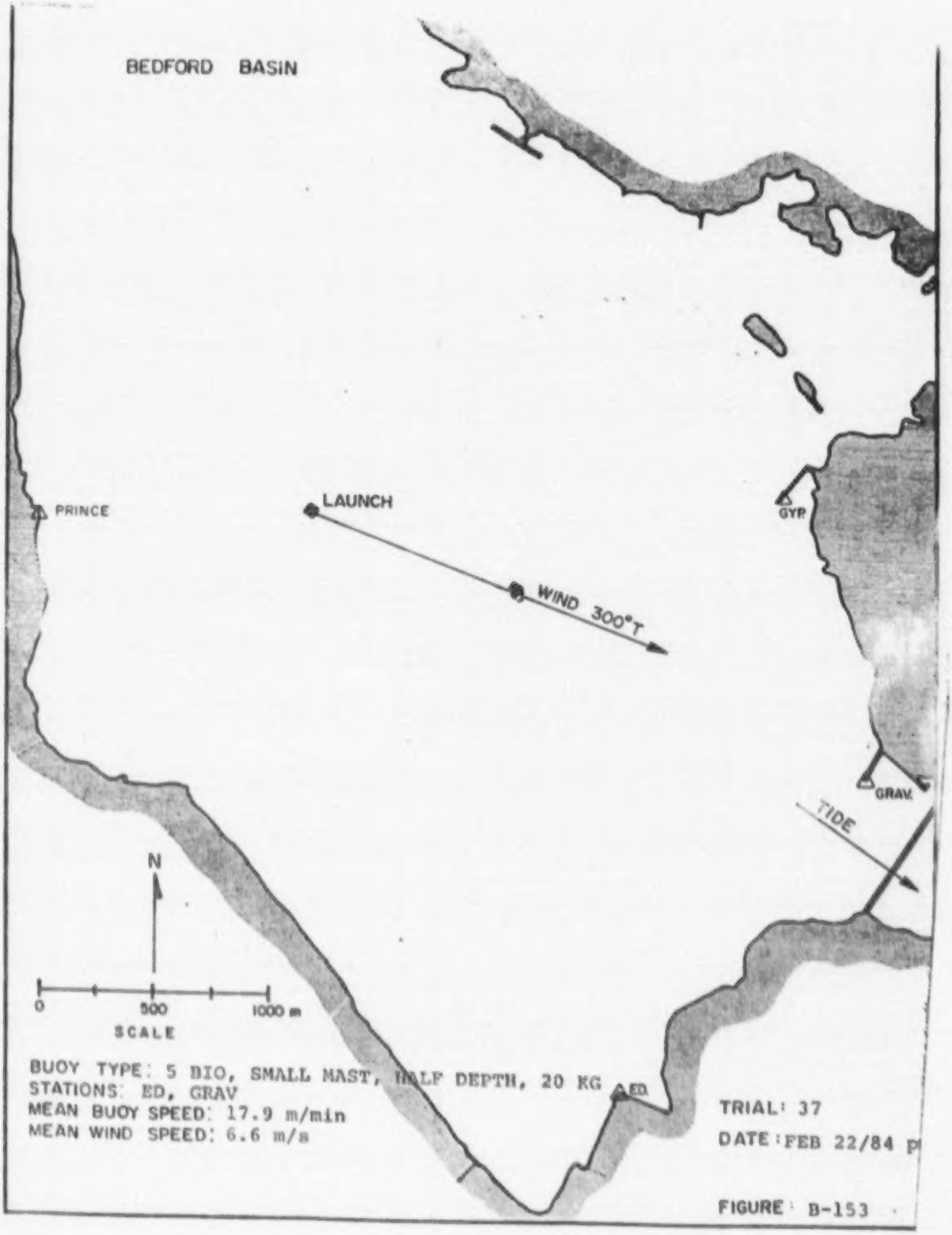
FIGURE B-151


BEDFORD BASIN
PRINCE
LAUNCH
GYR.
WIND 290° T
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, MED. MAST, HALF DEPTH, 20KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 20 m/min
MEAN WIND SPEED: 6.6 m/s

TRIAL: 37
DATE: FEB 22/84 pm

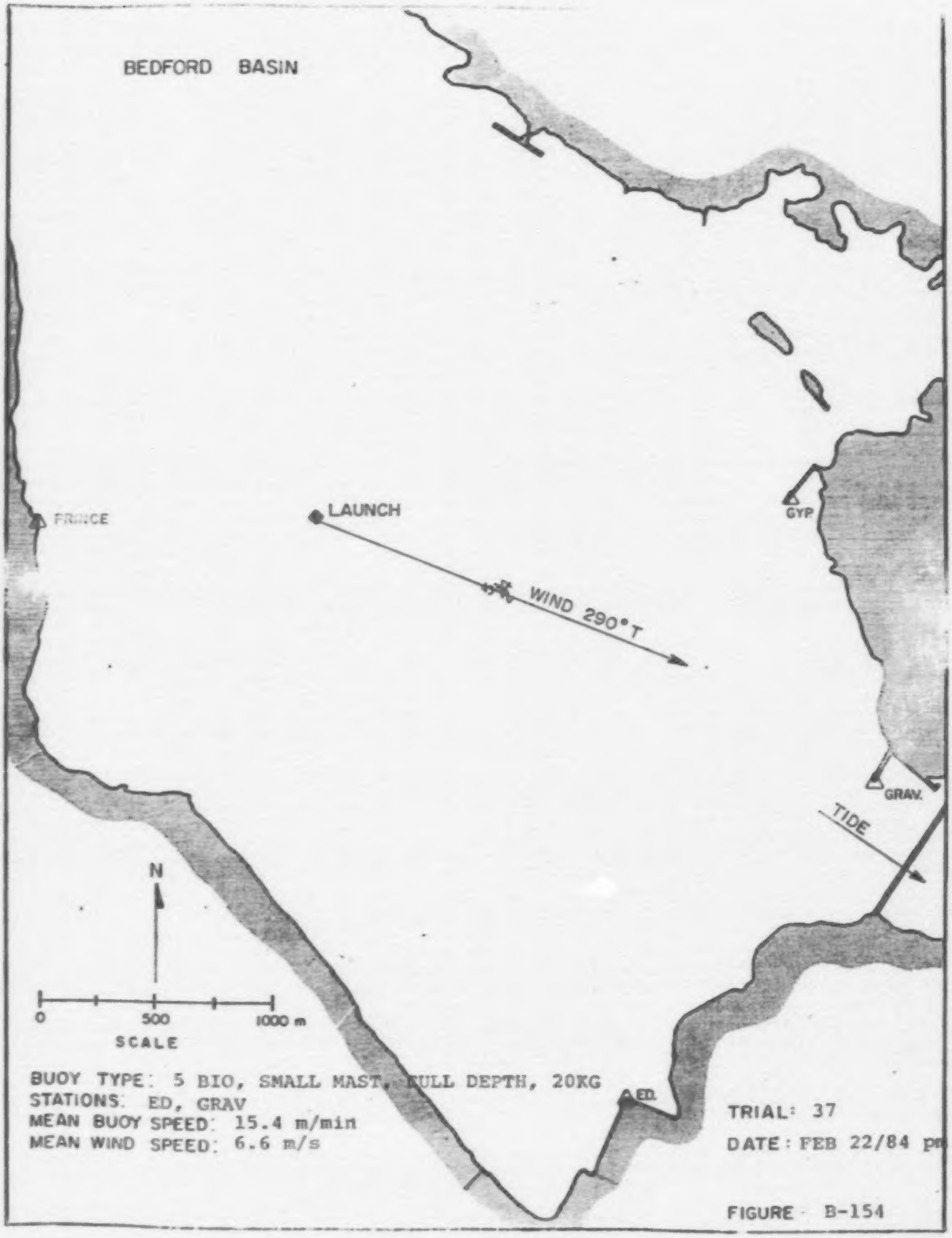
FIGURE: B-152


BEDFORD BASIN
LAUNCH
PRINCE
GYP.
WIND 300°T
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, SMALL MAST, HALF DEPTH, 20 KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 17.9 m/min
MEAN WIND SPEED: 6.6 m/s

TRIAL: 37
DATE: FEB 22/84 P

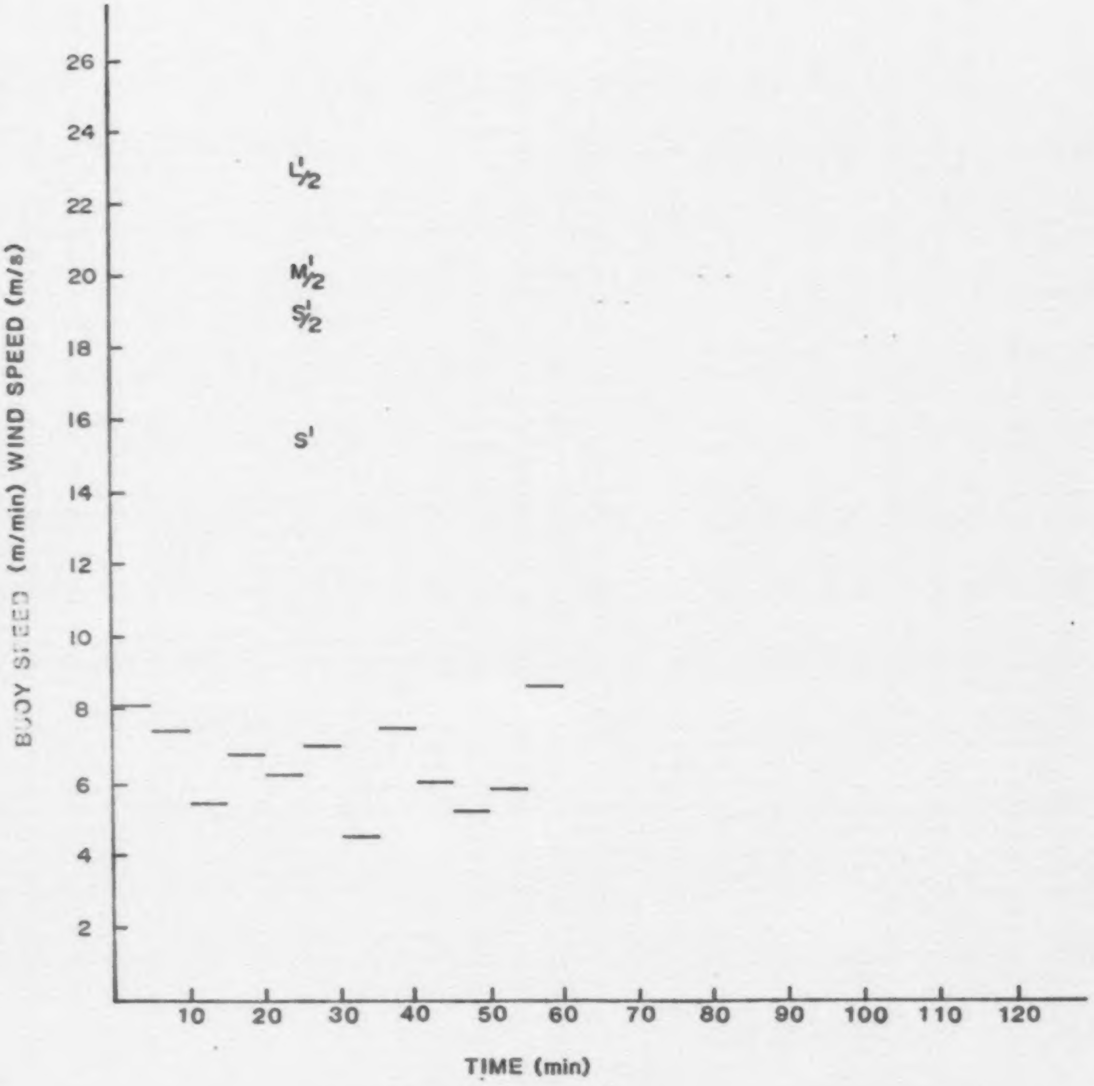
FIGURE: B-153


BEDFORD BASIN
PRINCE
LAUNCH
WIND 290°T
GYP.
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, SMALL MAST, FULL DEPTH, 20KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 15.4 m/min
MEAN WIND SPEED: 6.6 m/s

TRIAL: 37
DATE: FEB 22/84 pm

FIGURE B-154



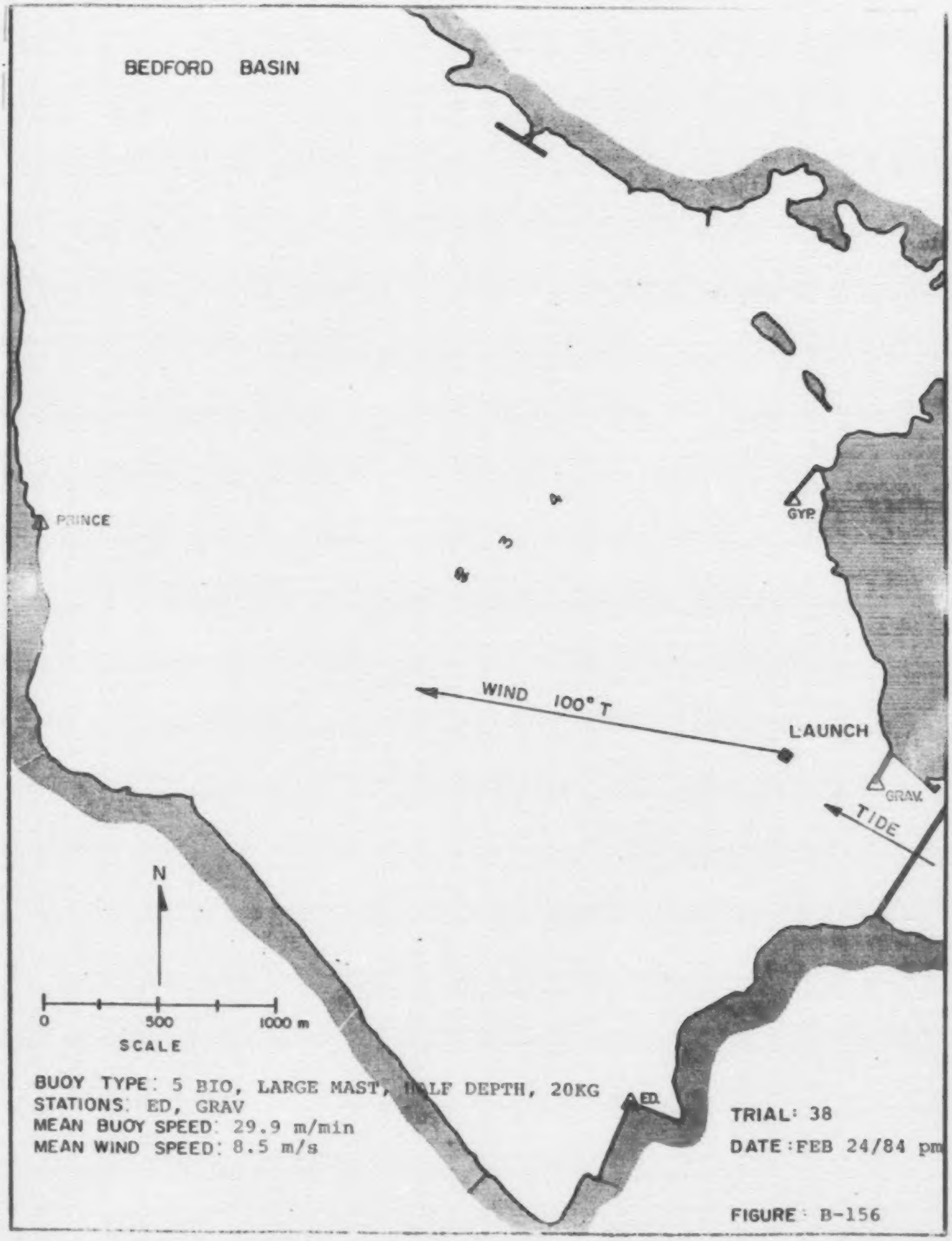
BUOY SPEED (ABSOLUTE, AT TIME BETWEEN FIXES) Vs TIME (ELAPSED)

LEGEND

L'/2 - BIO LARGE MAST, HALF DEPTH, 20KG
M'/2 - BIO MED. MAST, HALF DEPTH, 20KG
S'/2 - BIO SMALL MAST, HALF DEPTH, 20KG
S' - BIO SMALL MAST, FULL DEPTH, 20KG
--- - WIND

TRIAL : 37
DATE : FEB 22/84 pm
TIDE : HI - 1200
LOW - 1910

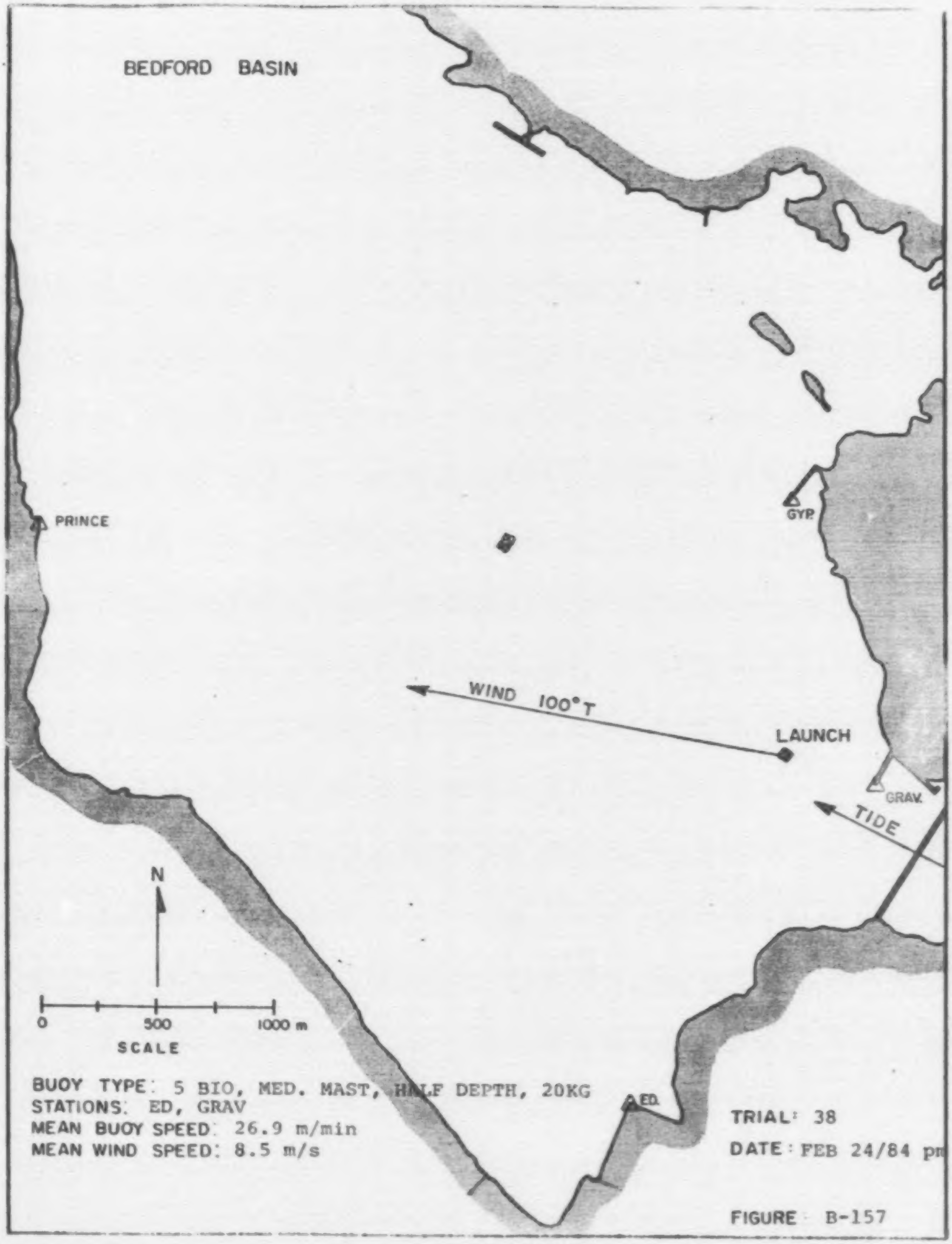
AV. WIND SPEED : 6.6 m/s
FIGURE : B-155


BEDFORD BASIN
PRINCE
GYP.
LAUNCH
WIND 100° T
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, LARGE MAST, HALF DEPTH, 20KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 29.9 m/min
MEAN WIND SPEED: 8.5 m/s

TRIAL: 38
DATE: FEB 24/84 pm

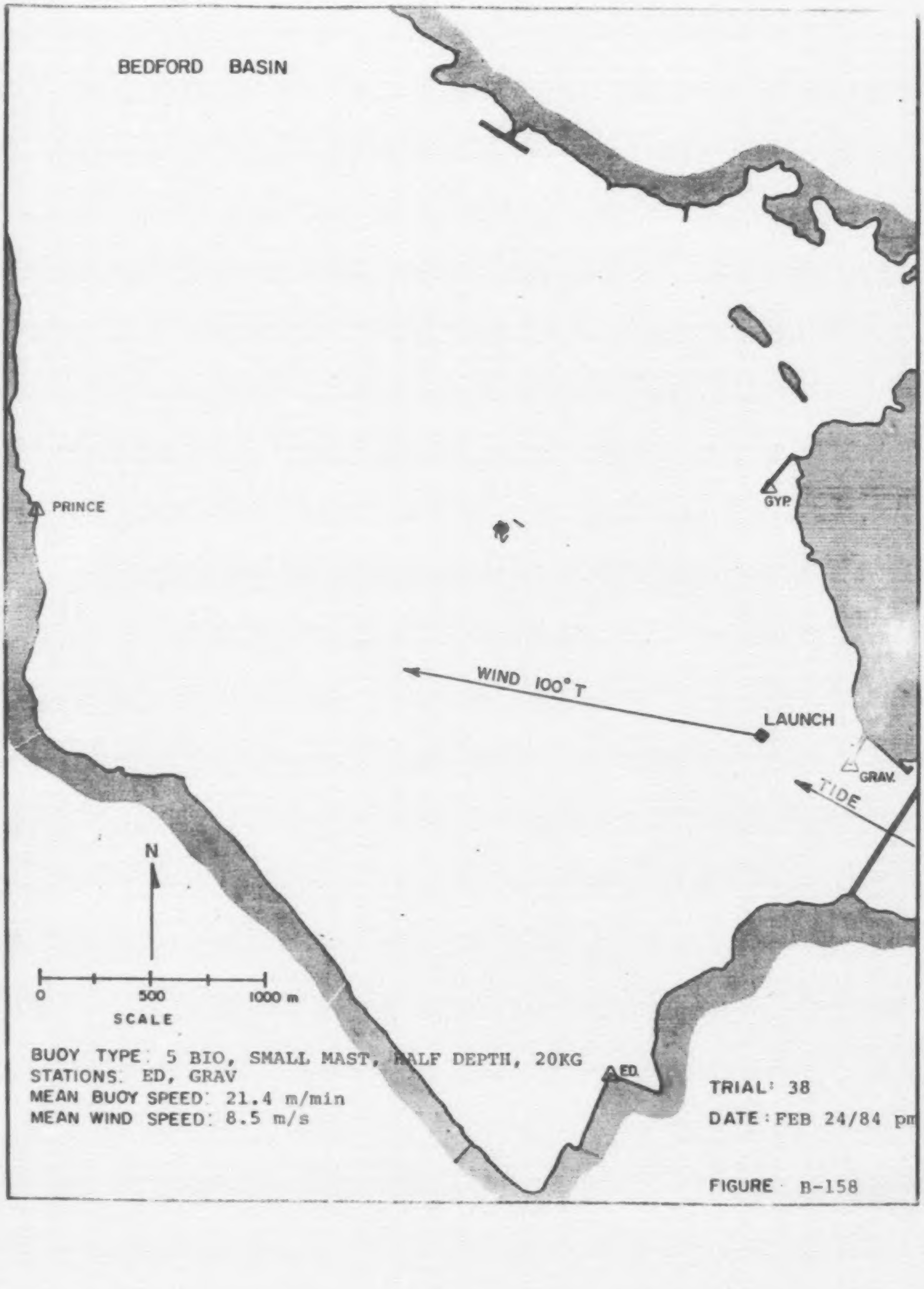
FIGURE: B-156


BEDFORD BASIN
PRINCE
GYP.
WIND 100° T
LAUNCH
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, MED. MAST, HALF DEPTH, 20KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 26.9 m/min
MEAN WIND SPEED: 8.5 m/s

TRIAL: 38
DATE: FEB 24/84 p

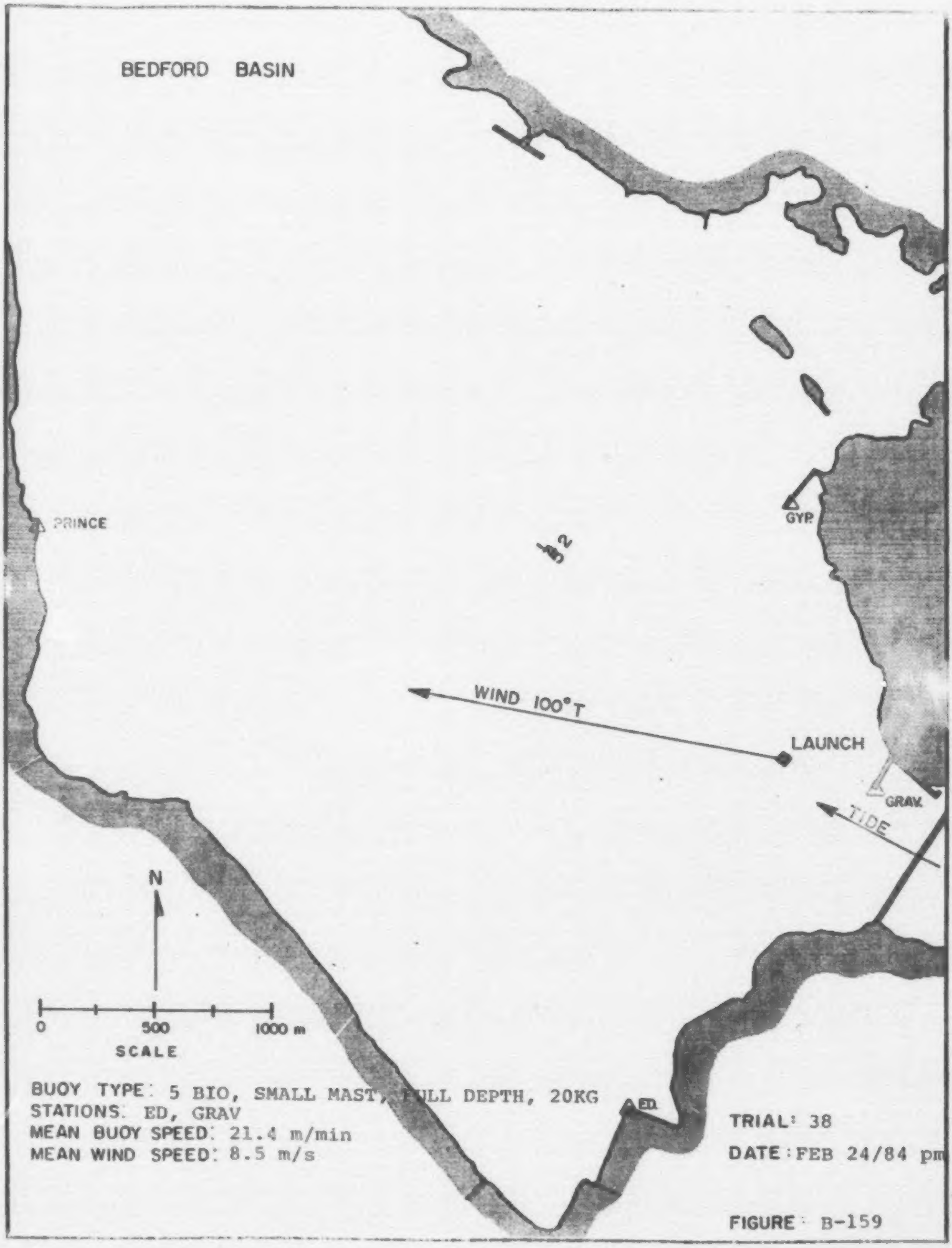
FIGURE B-157


BEDFORD BASIN
PRINCE
GYP.
WIND 100° T
LAUNCH
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, SMALL MAST, HALF DEPTH, 20KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 21.4 m/min
MEAN WIND SPEED: 8.5 m/s

TRIAL: 38
DATE: FEB 24/84 pm

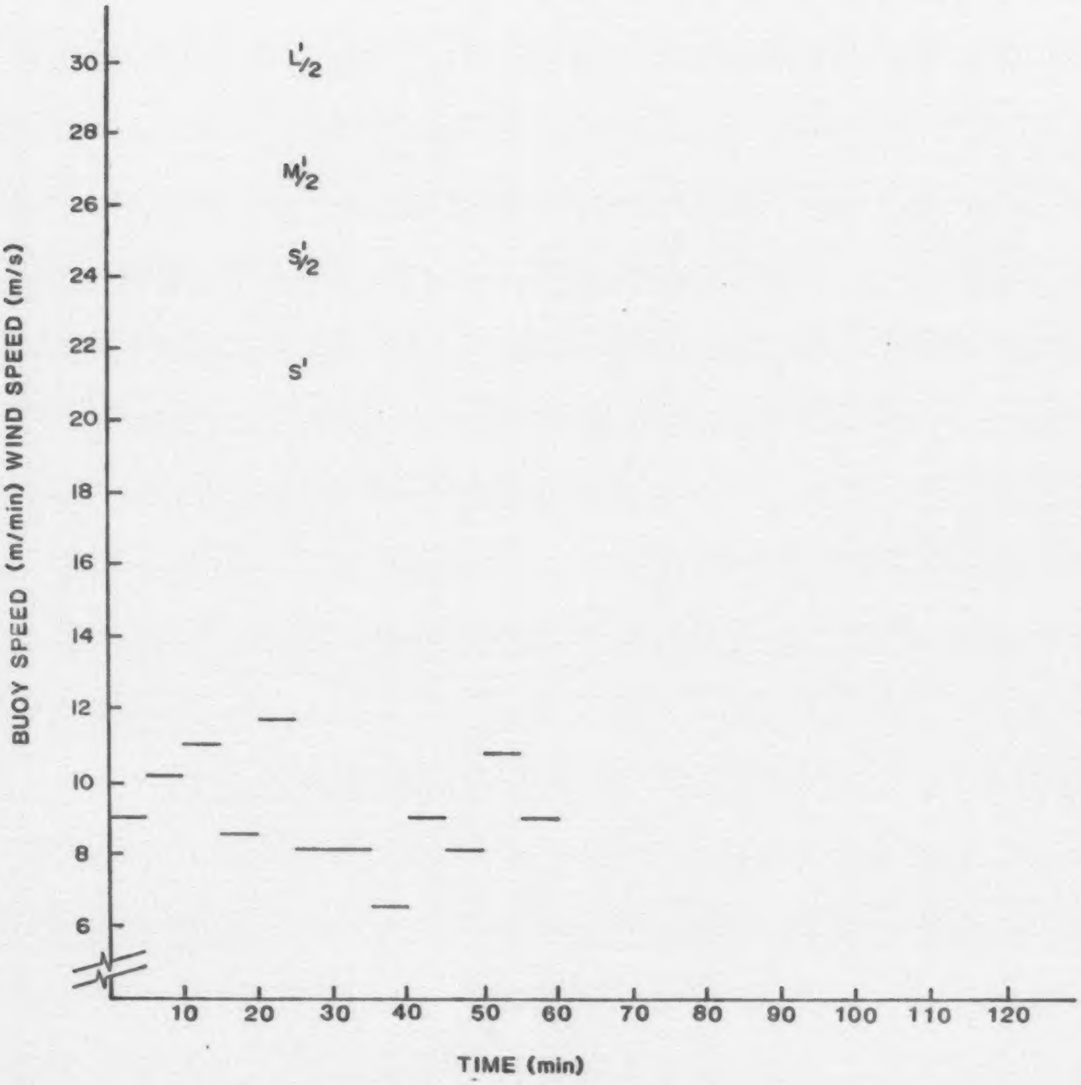
FIGURE B-158


BEDFORD BASIN
PRINCE
GYP.
WIND 100°T
LAUNCH
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, SMALL MAST, FULL DEPTH, 20KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 21.4 m/min
MEAN WIND SPEED: 8.5 m/s

TRIAL: 38
DATE: FEB 24/84 pm

FIGURE: B-159



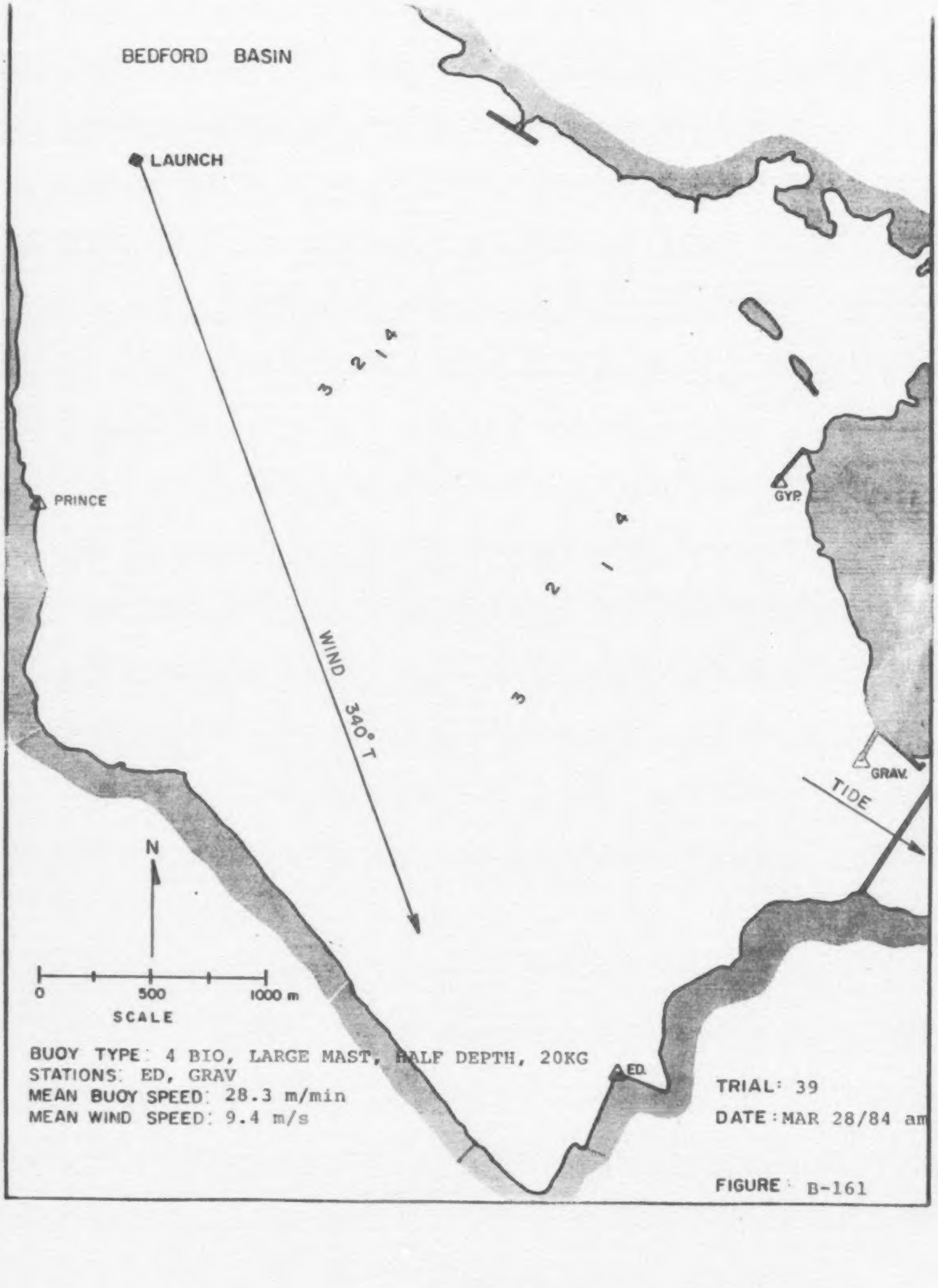
BUOY SPEED (ABSOLUTE, AT
TIME BETWEEN FIXES) Vs TIME (ELAPSED)

LEGEND

$L'/_2$ - BIO LARGE MAST, HALF DEPTH, 20KG
$M'/_2$ - BIO MED. MAST, HALF DEPTH, 20KG
$S'/_2$ - BIO SMALL MAST, HALF DEPTH, 20KG
S' - BIO SMALL MAST, FULL DEPTH, 20KG
--- - WIND

TRIAL : 38
DATE : FEB 24/84 pm
TIDE : HI - 1410
LOW - 2105

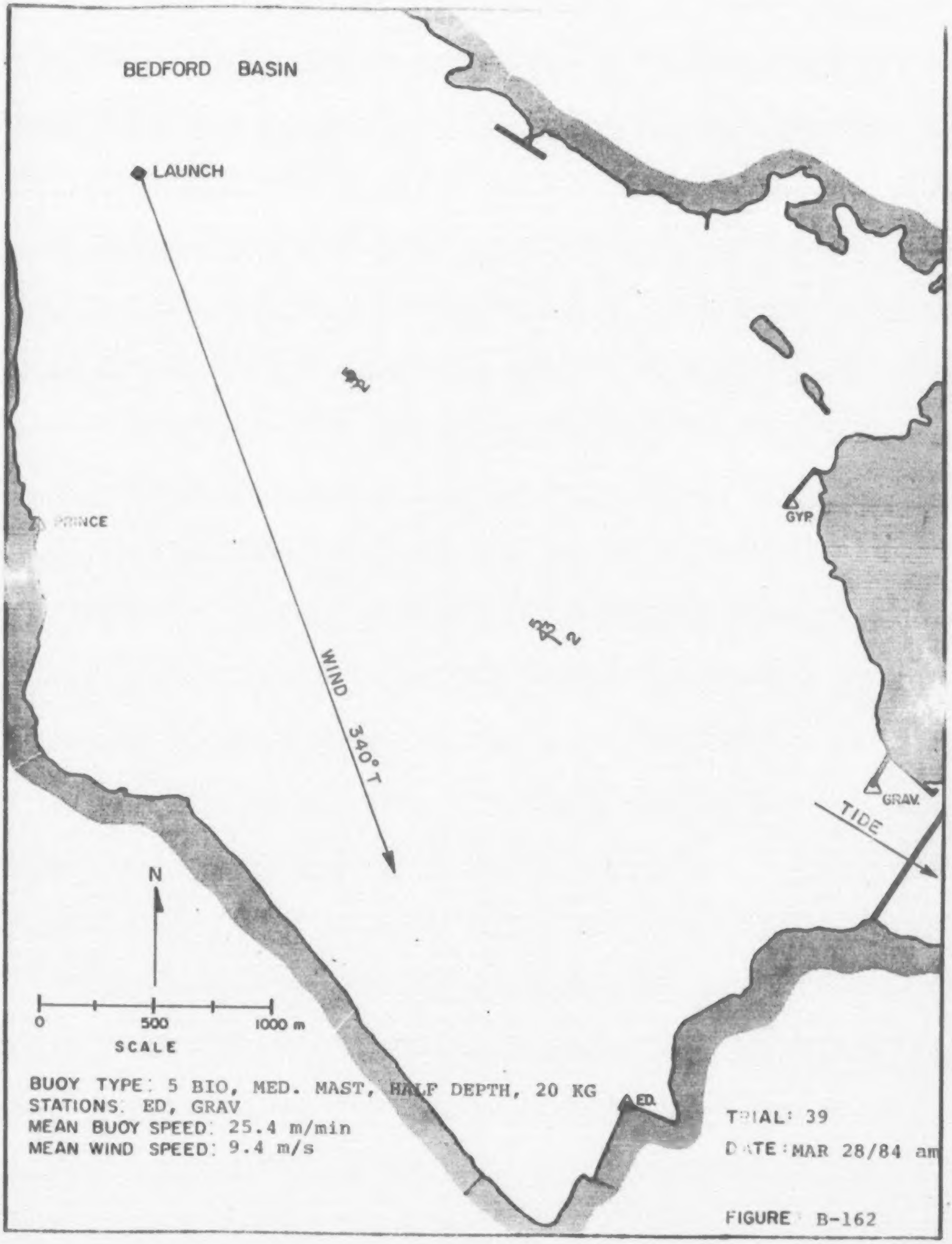
AV. WIND SPEED : 8.5 m/s
FIGURE : B-160


BEDFORD BASIN
LAUNCH
3 2 1 4
PRINCE
GYP.
2 1 4
WIND 340° T
3
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 4 BIO, LARGE MAST, HALF DEPTH, 20KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 28.3 m/min
MEAN WIND SPEED: 9.4 m/s

TRIAL: 39
DATE: MAR 28/84 am

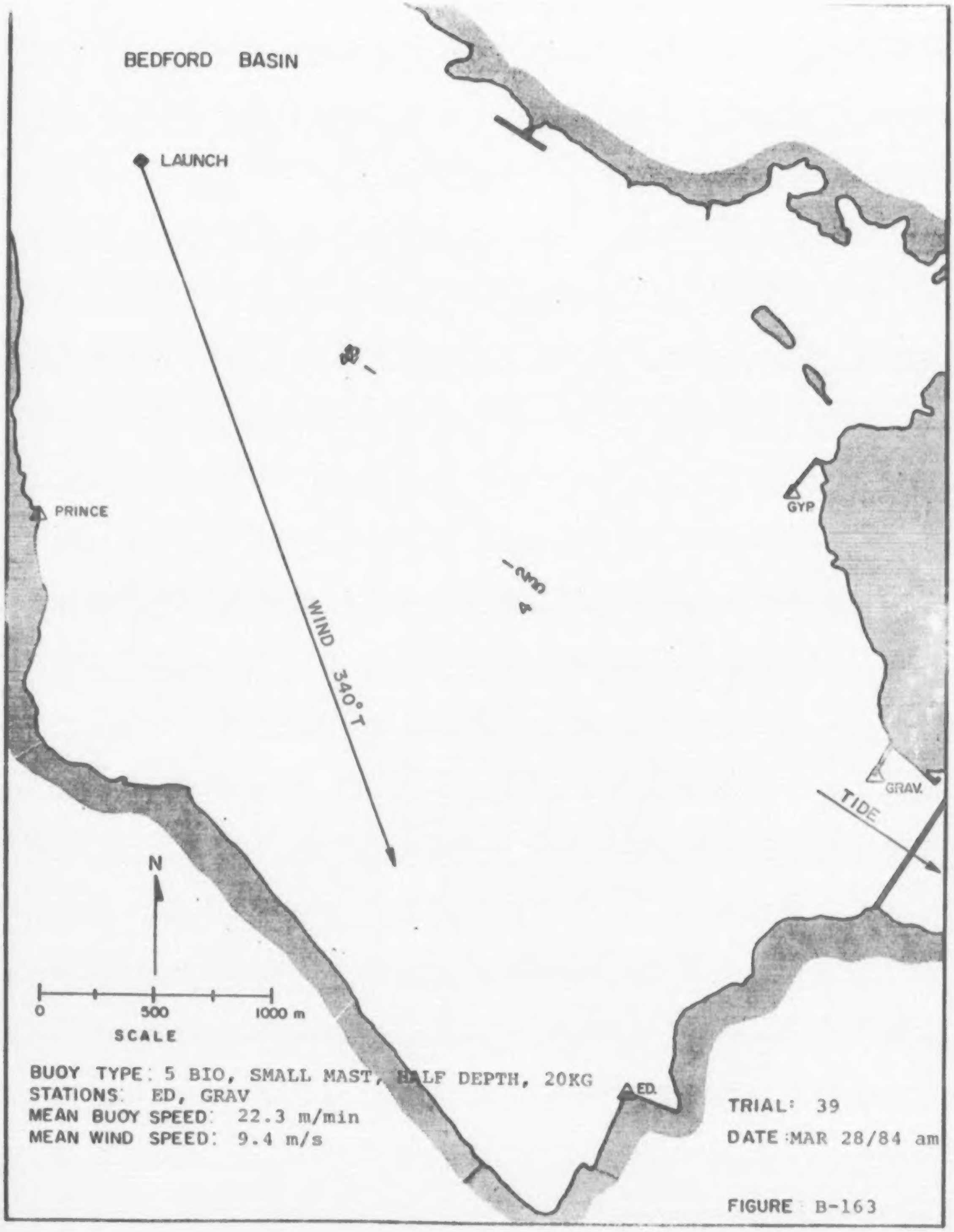
FIGURE: B-161


BEDFORD BASIN
LAUNCH
PRINCE
GYP.
GRAV.
ED.
WIND 340°T
TIDE
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, MED. MAST, HALF DEPTH, 20 KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 25.4 m/min
MEAN WIND SPEED: 9.4 m/s

TRIAL: 39
DATE: MAR 28/84 am

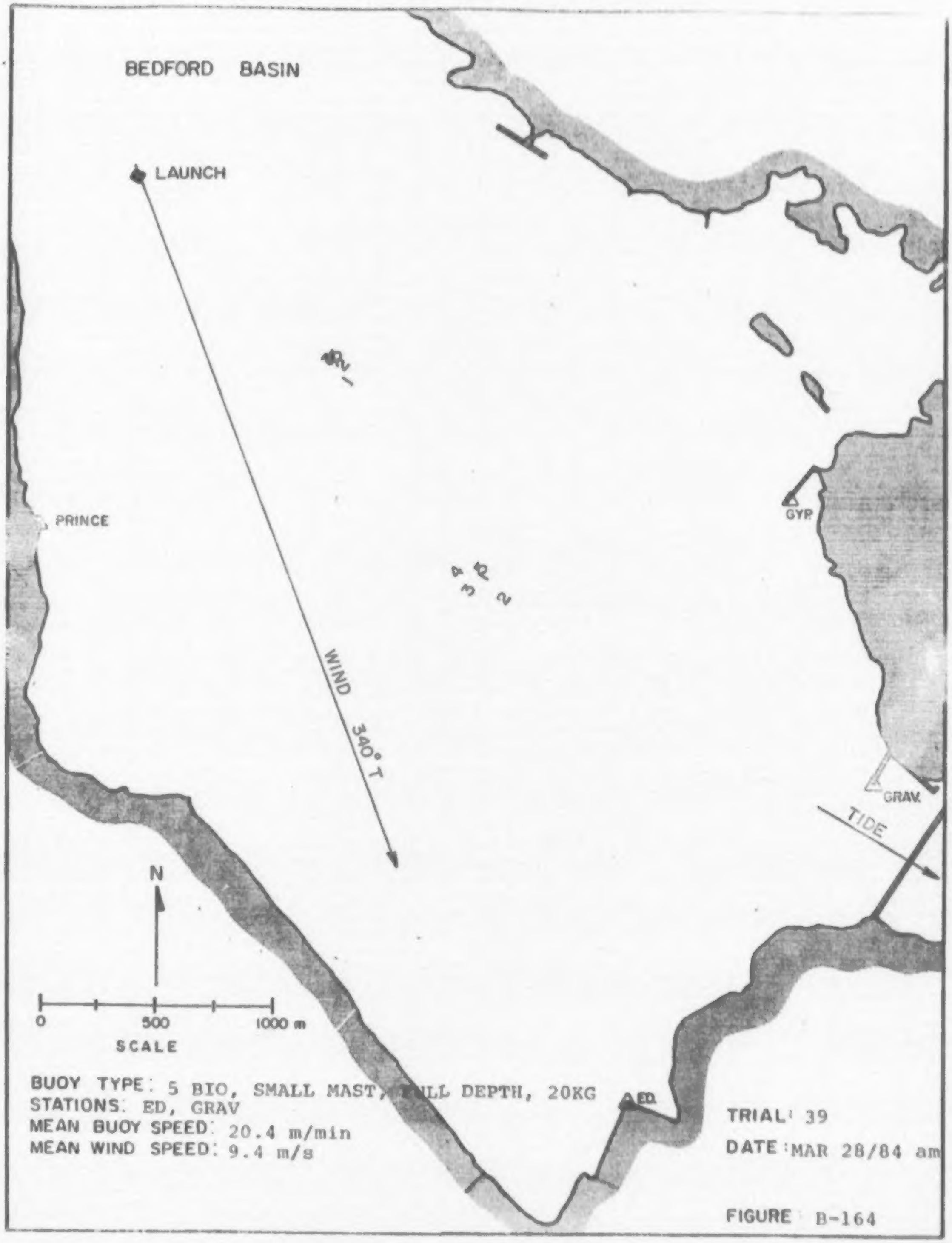
FIGURE B-162


BEDFORD BASIN
LAUNCH
PRINCE
GYP
GRAV.
TIDE
WIND 340° T
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, SMALL MAST, HALF DEPTH, 20KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 22.3 m/min
MEAN WIND SPEED: 9.4 m/s

TRIAL: 39
DATE: MAR 28/84 am

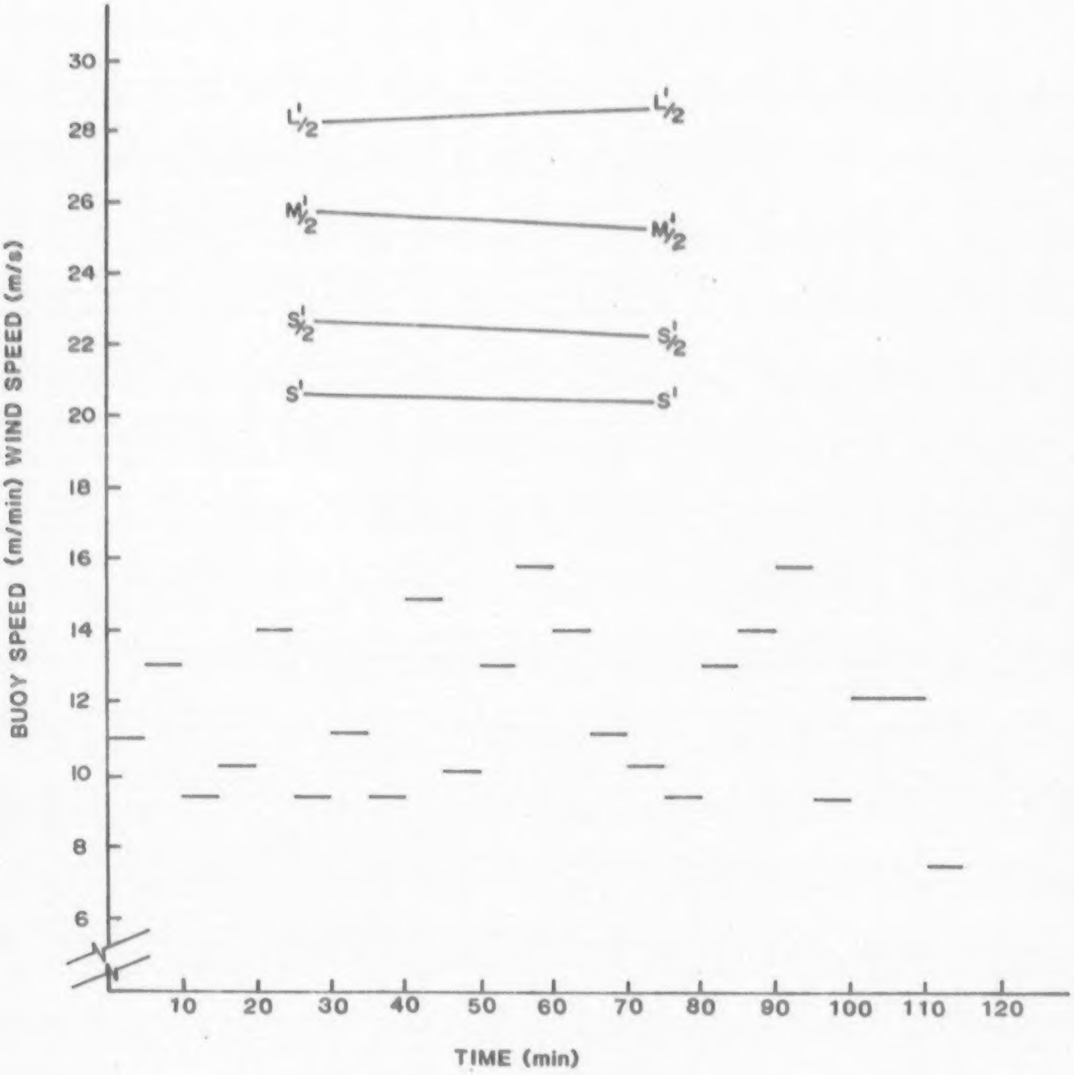
FIGURE B-163


BEDFORD BASIN
LAUNCH
1
2
4
3
2
2
PRINCE
GYP.
GRAV.
TIDE
WIND 340° T
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, SMALL MAST, FULL DEPTH, 20KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 20.4 m/min
MEAN WIND SPEED: 9.4 m/s

TRIAL: 39
DATE: MAR 28/84 am

FIGURE B-164

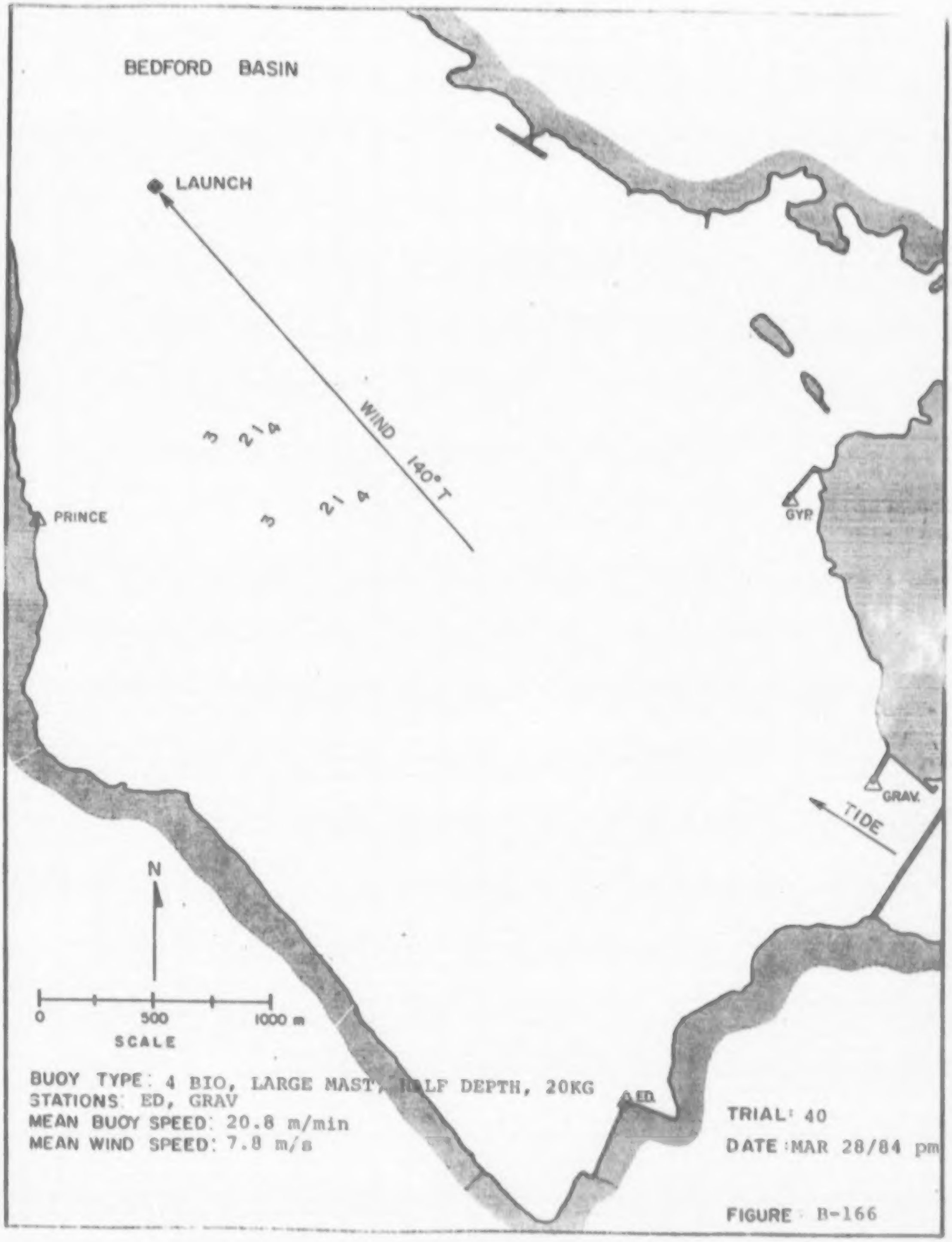


BUOY SPEED (ABSOLUTE, AT
TIME BETWEEN FIXES) Vs TIME (ELAPSED)

LEGEND

$L'/_2$ - BIO LARGE MAST, HALF DEPTH, 20KG
$M'/_2$ - BIO MED. MAST, HALF DEPTH, 20KG
$S'/_2$ - BIO SMALL MAST, HALF DEPTH, 20KG
S' - BIO SMALL MAST, HALF DEPTH, 20KG
--- - WIND

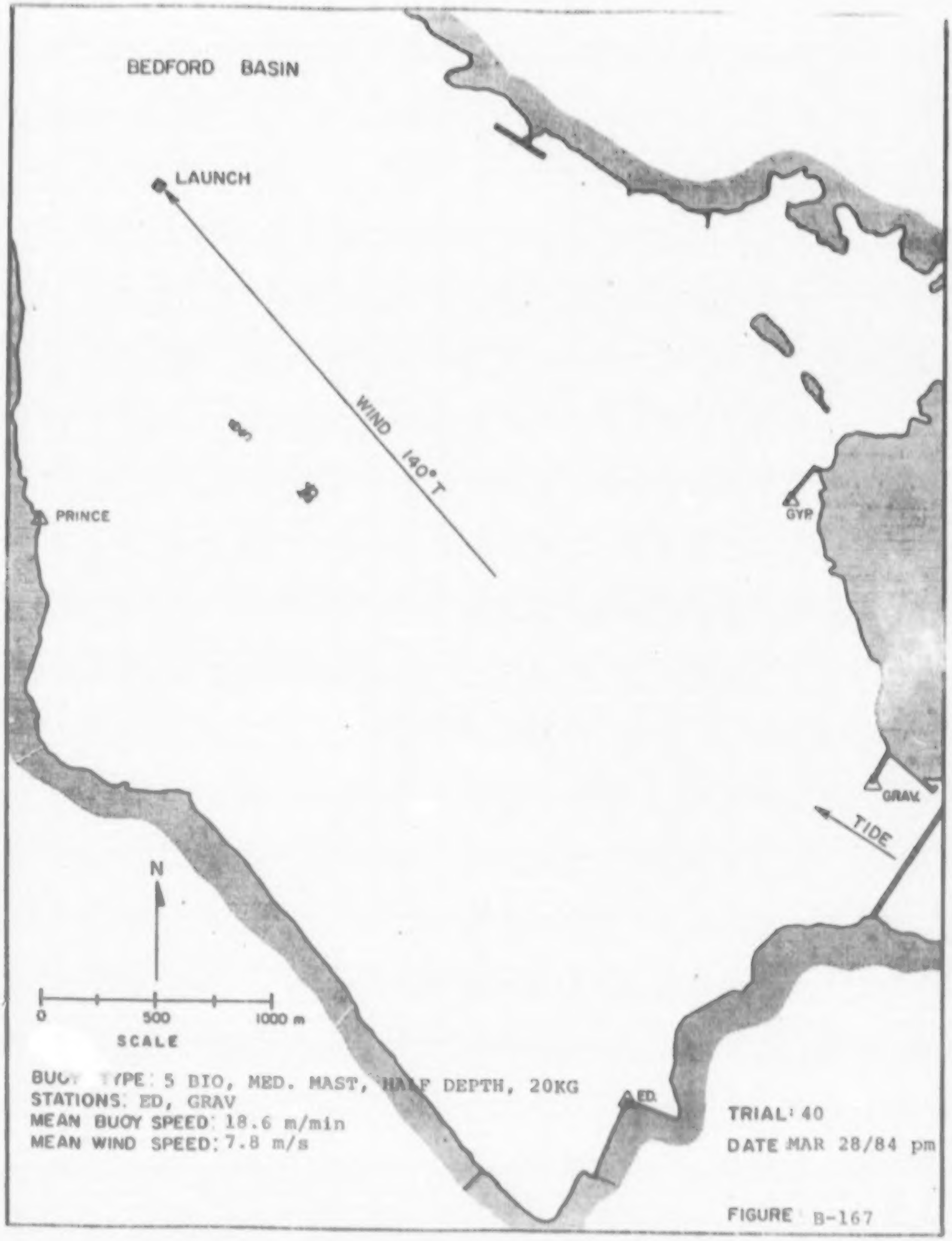
TRIAL : 39
DATE : MAR 28/84 am
TIDE : HI - 0525
LOW - 1150
AV. WIND SPEED : 9.4 m/s
FIGURE : B-165


BEDFORD BASIN
LAUNCH
WIND 140° T
3 2 1 4
3 2 1 4
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 4 BIO, LARGE MAST, HALF DEPTH, 20KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 20.8 m/min
MEAN WIND SPEED: 7.8 m/s

TRIAL: 40
DATE: MAR 28/84 pm

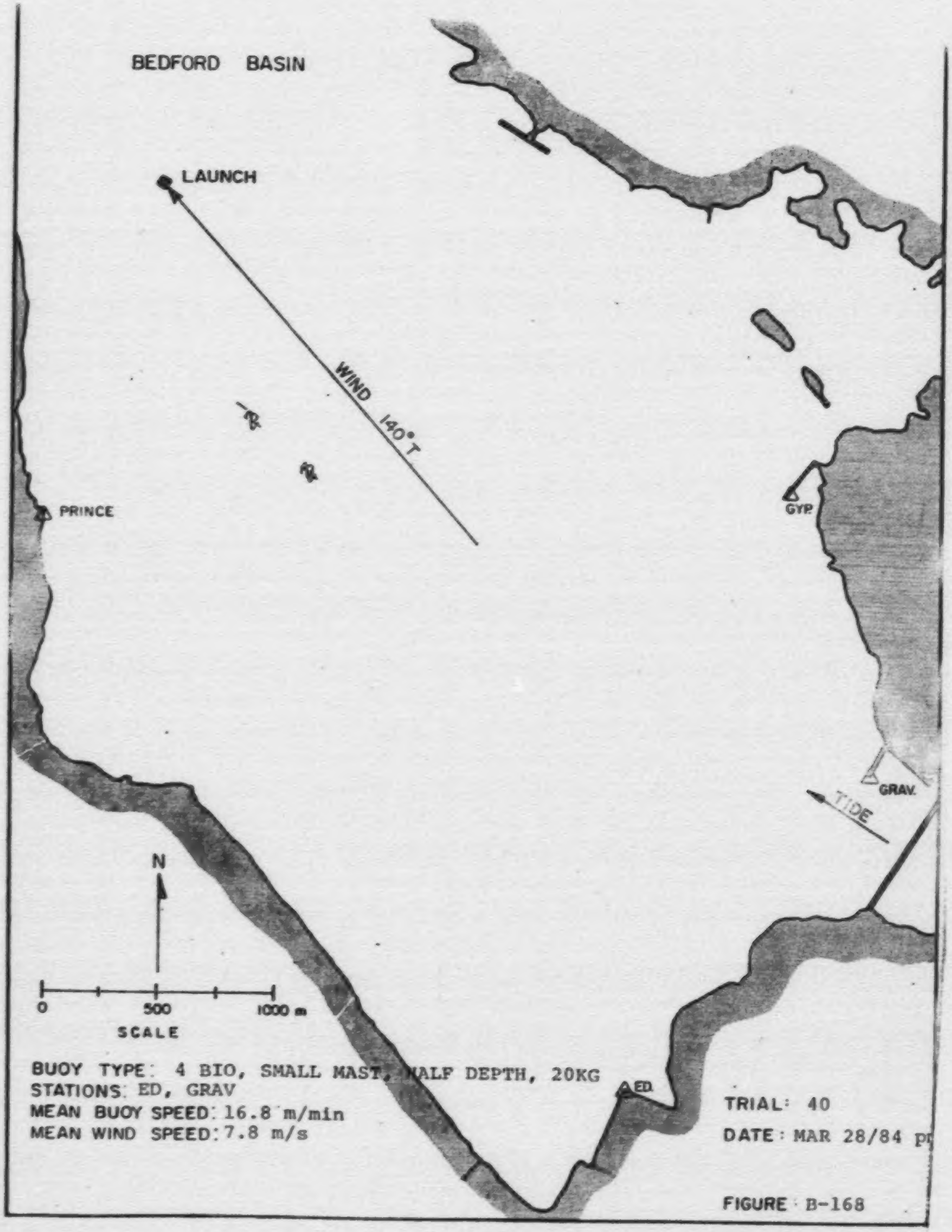
FIGURE B-166


BEDFORD BASIN
LAUNCH
WIND 140°T
PRINCE
GYP.
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, MED. MAST, HALF DEPTH, 20KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 18.6 m/min
MEAN WIND SPEED: 7.8 m/s

TRIAL: 40
DATE MAR 28/84 pm

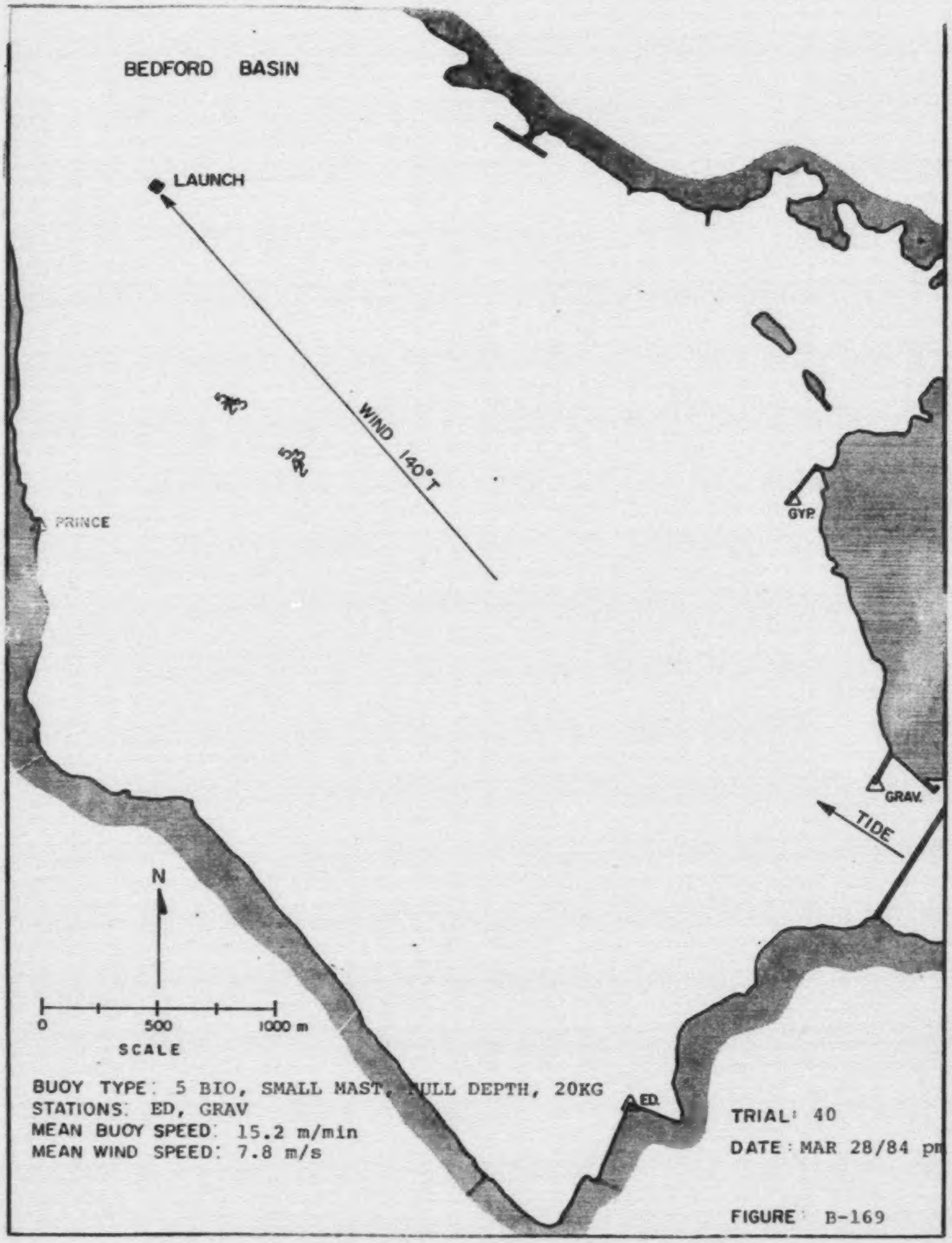
FIGURE B-167


BEDFORD BASIN
LAUNCH
WIND 140° T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 4 BIO, SMALL MAST, HALF DEPTH, 20KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 16.8 m/min
MEAN WIND SPEED: 7.8 m/s

TRIAL: 40
DATE: MAR 28/84 p

FIGURE: B-168

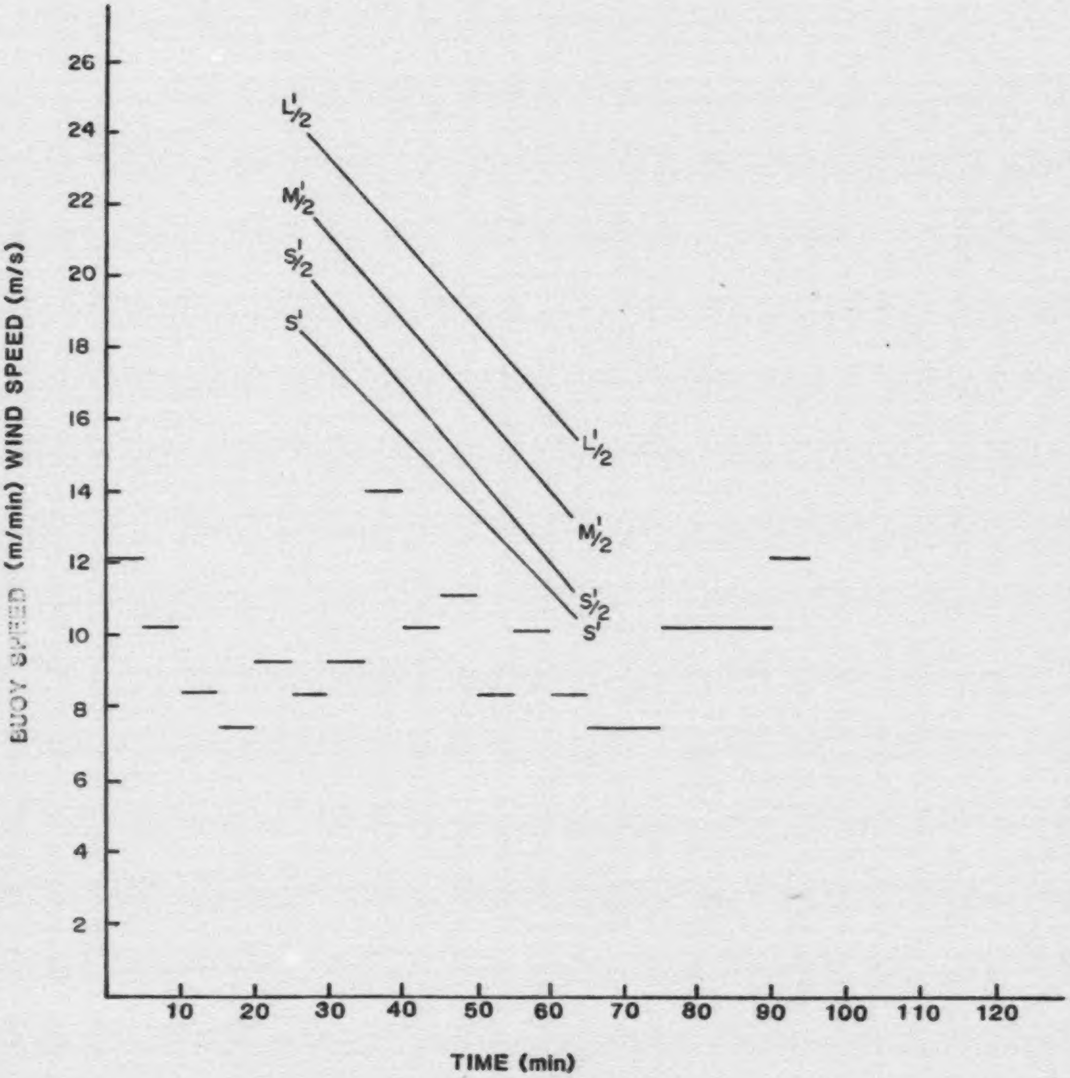

BEDFORD BASIN
LAUNCH
WIND 140°T
PRINCE
GYP.
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, SMALL MAST, FULL DEPTH, 20KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 15.2 m/min
MEAN WIND SPEED: 7.8 m/s

TRIAL: 40

DATE: MAR 28/84 p

FIGURE B-169



BUOY SPEED (ABSOLUTE, AT TIME BETWEEN FIXES) Vs TIME (ELAPSED)

LEGEND

- $L'/_2$ - BIO LARGE MAST, HALF DEPTH, 20KG
- $M'/_2$ - BIO MED. MAST, HALF DEPTH, 20KG
- $S'/_2$ - BIO SMALL MAST, HALF DEPTH, 20KG
- S' - BIO SMALL MAST, FULL DEPTH, 20KG
- --- - WIND

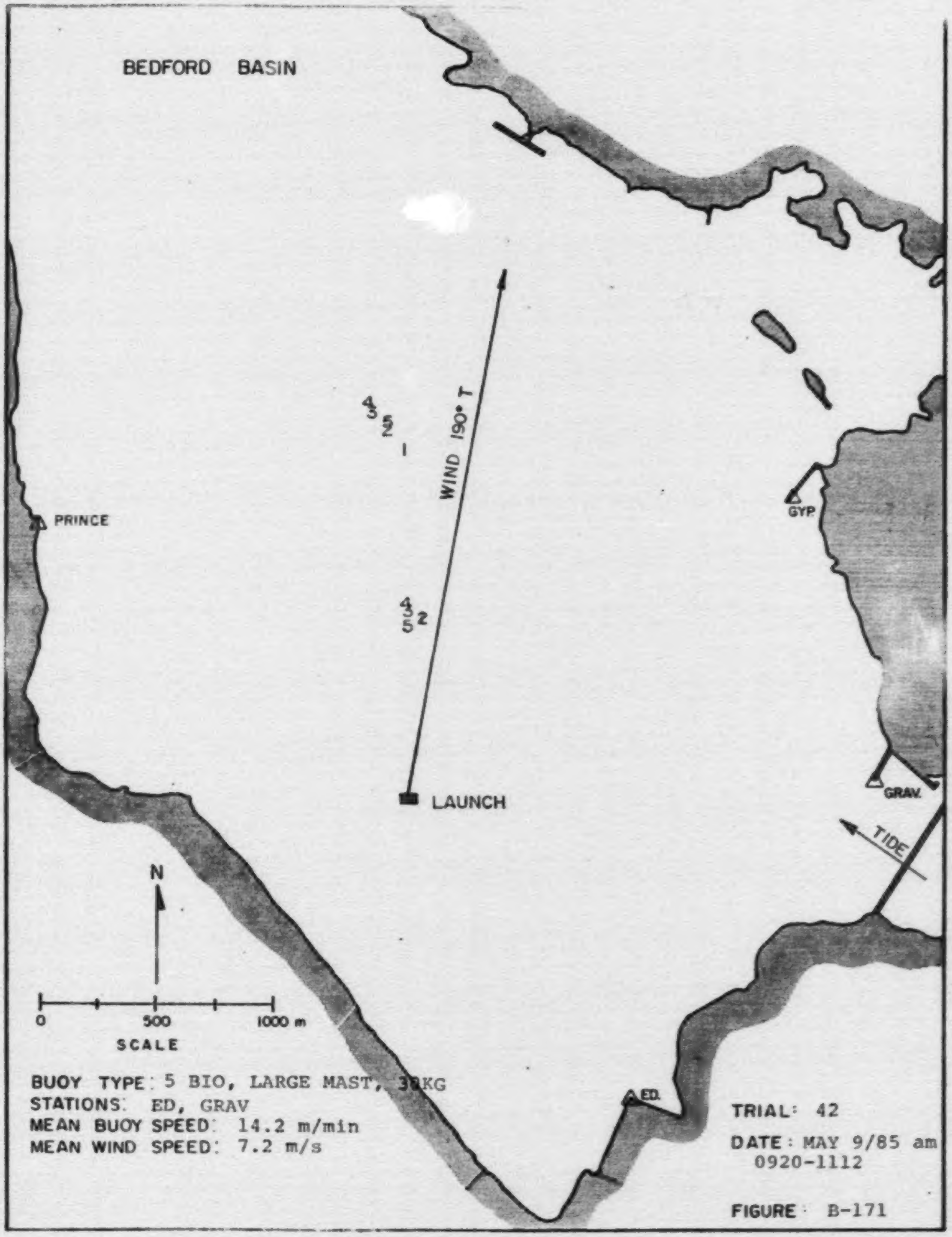
TRIAL : 40

DATE : MAR 28/84

TIDE : LOW - 1150
HI - 1810

AV. WIND SPEED : 7.8 m/s

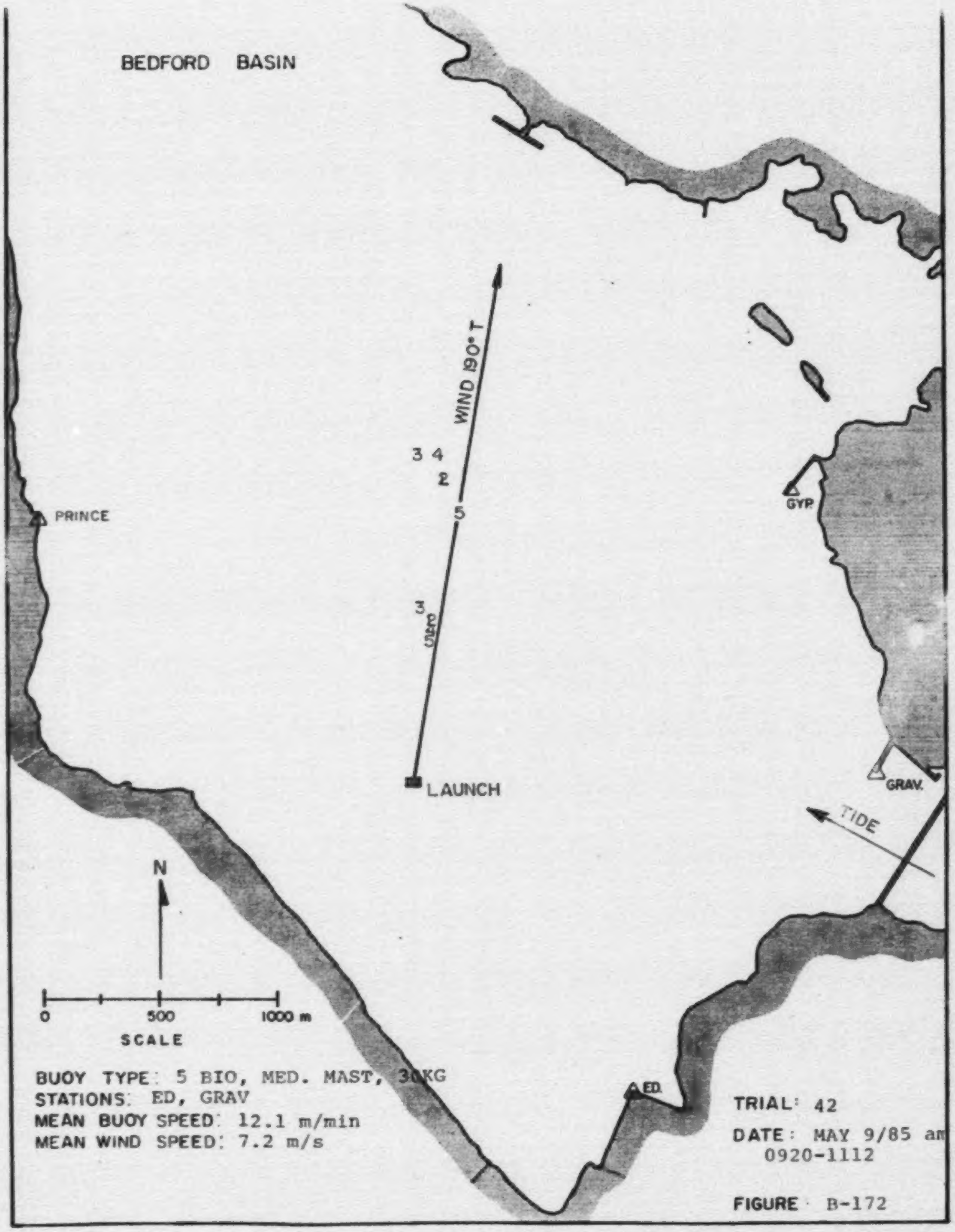
FIGURE : B-170


BEDFORD BASIN
4
3
5
2
1
WIND 190° T
PRINCE
GYP.
4
3
5
2
LAUNCH
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, LARGE MAST, 30KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 14.2 m/min
MEAN WIND SPEED: 7.2 m/s

TRIAL: 42
DATE: MAY 9/85 am
0920-1112

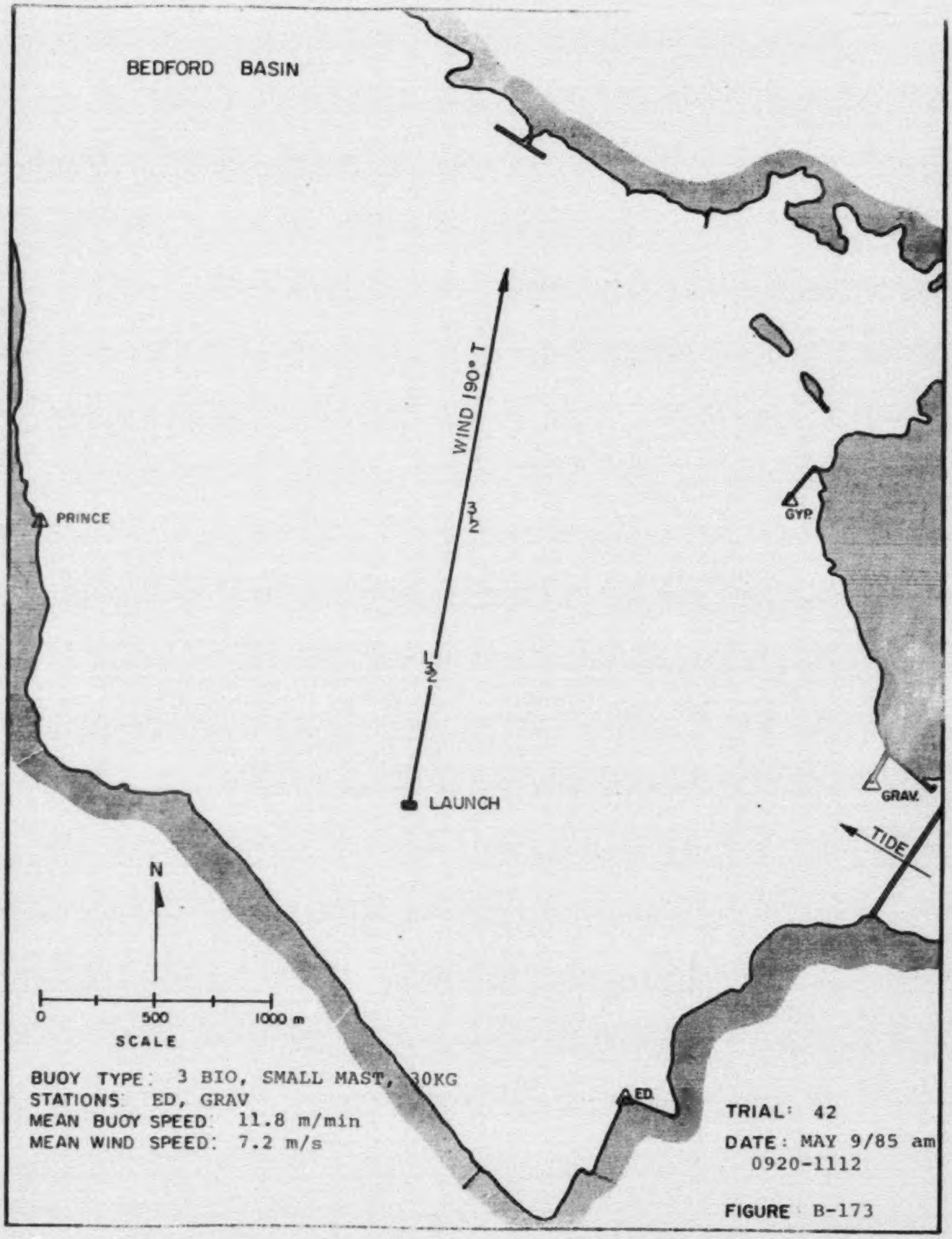
FIGURE: B-171


BEDFORD BASIN
WIND 190° T
3 4
2
5
3
2
PRINCE
GYP.
GRAV.
LAUNCH
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, MED. MAST, 30KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 12.1 m/min
MEAN WIND SPEED: 7.2 m/s

TRIAL: 42
DATE: MAY 9/85 am
0920-1112

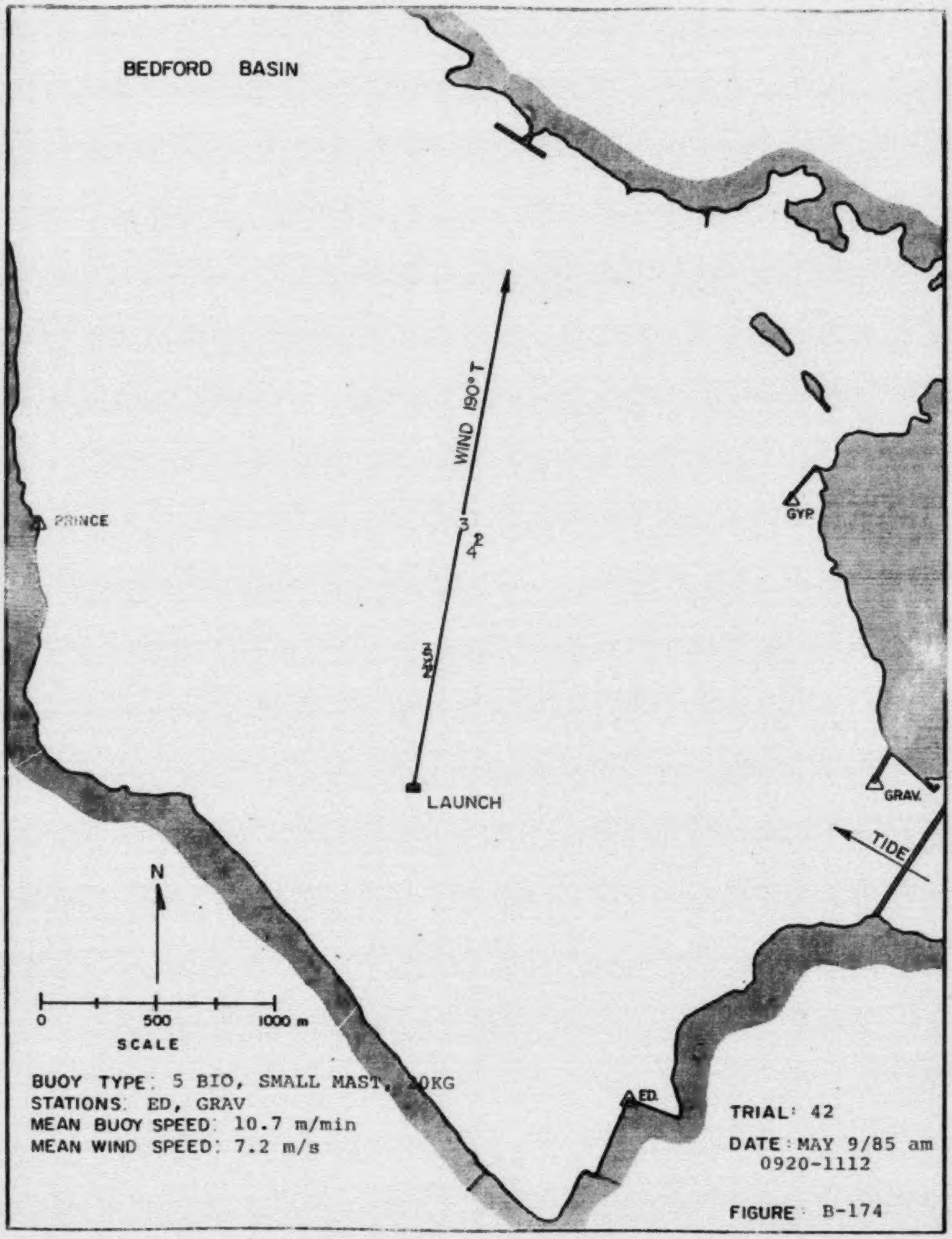
FIGURE B-172


BEDFORD BASIN
WIND 190° T
3
2
L
3
2
LAUNCH
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 3 BIO, SMALL MAST, 30KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 11.8 m/min
MEAN WIND SPEED: 7.2 m/s

TRIAL: 42
DATE: MAY 9/85 am
0920-1112

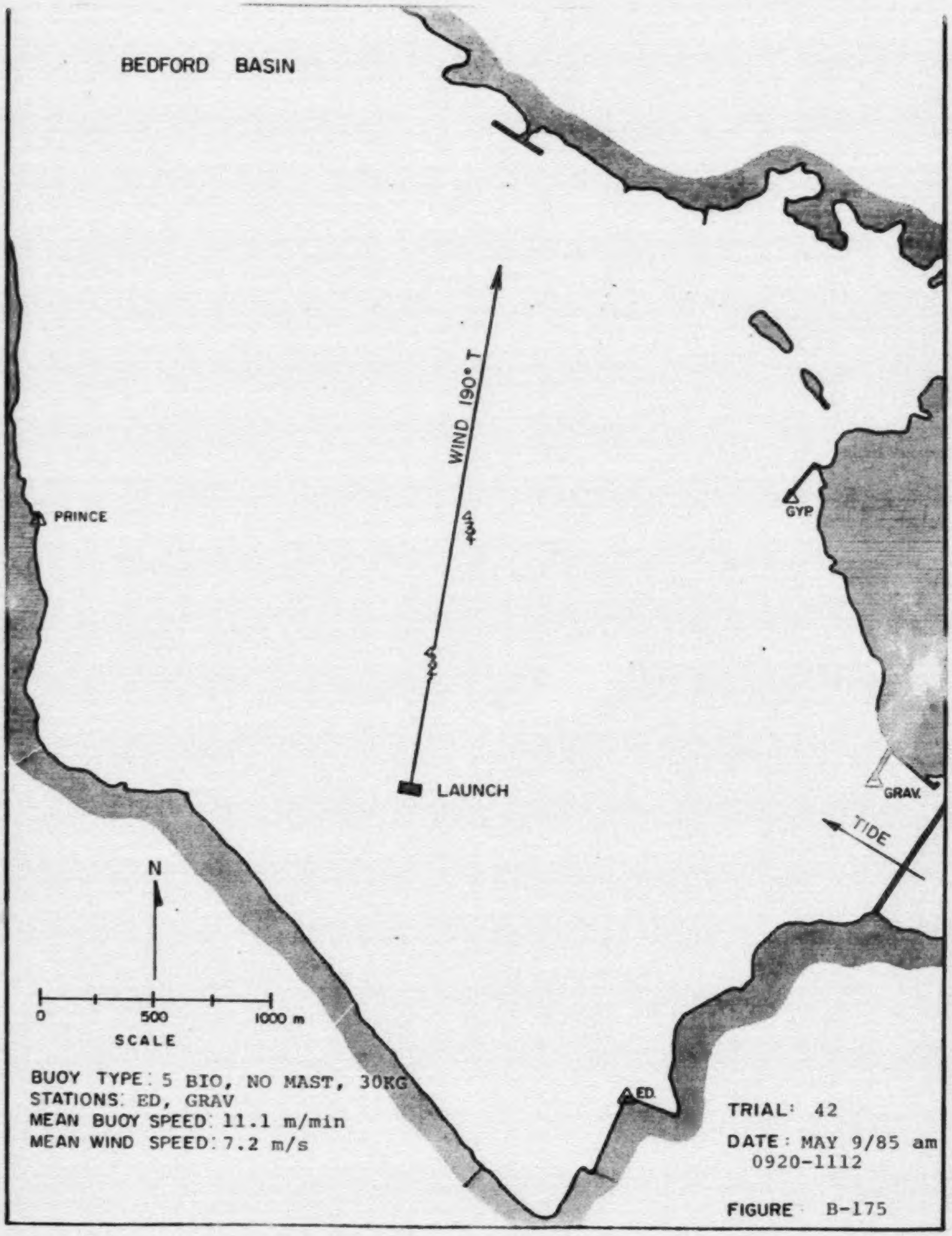
FIGURE B-173


BEDFORD BASIN
WIND 190° T
3
2
4
3
5
4
2
LAUNCH
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, SMALL MAST, 20KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 10.7 m/min
MEAN WIND SPEED: 7.2 m/s

TRIAL: 42
DATE: MAY 9/85 am
0920-1112

FIGURE: B-174

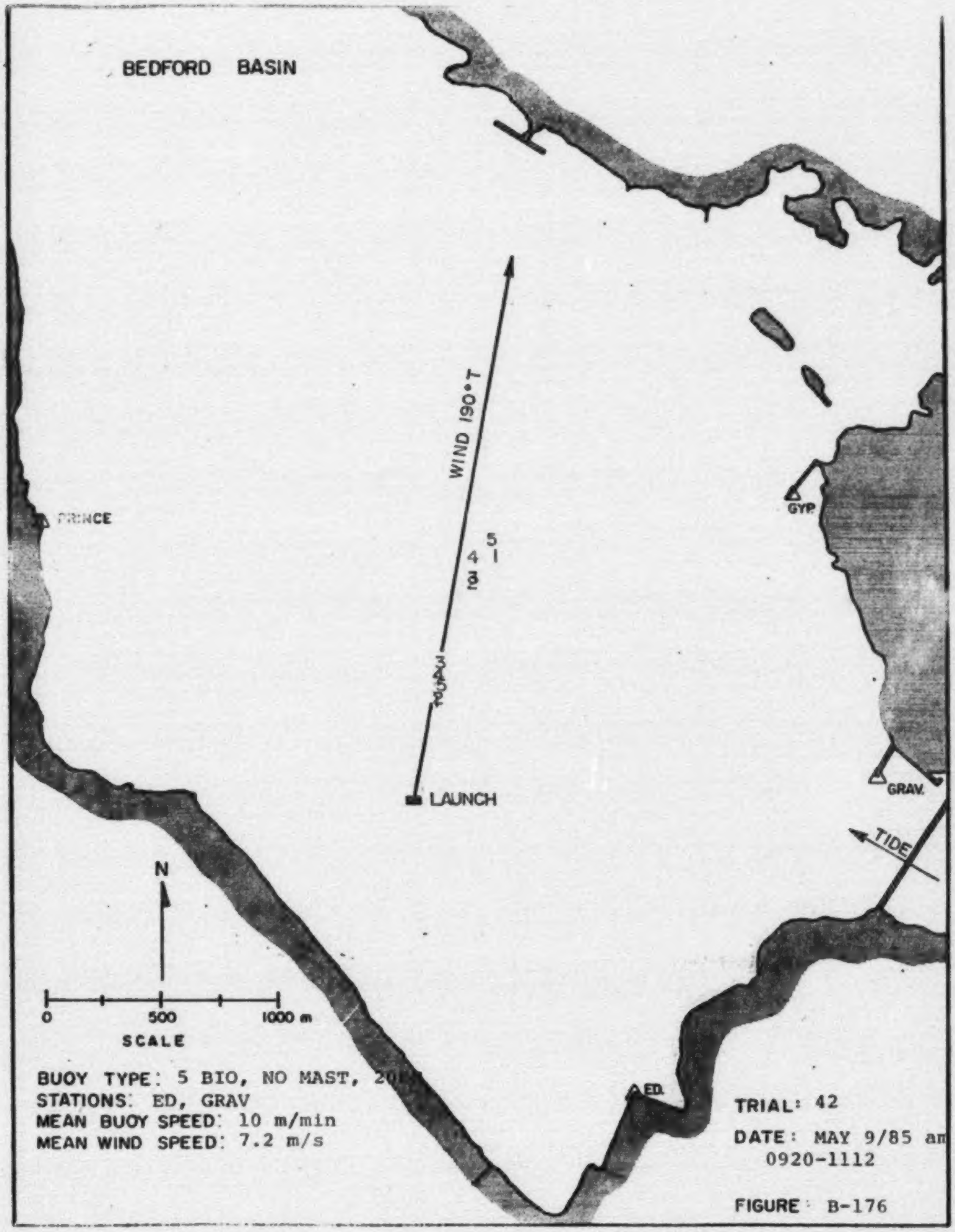

BEDFORD BASIN
WIND 190° T
PRINCE
GYP
GRAV.
LAUNCH
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, NO MAST, 30KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 11.1 m/min
MEAN WIND SPEED: 7.2 m/s

TRIAL: 42

DATE: MAY 9/85 am
0920-1112

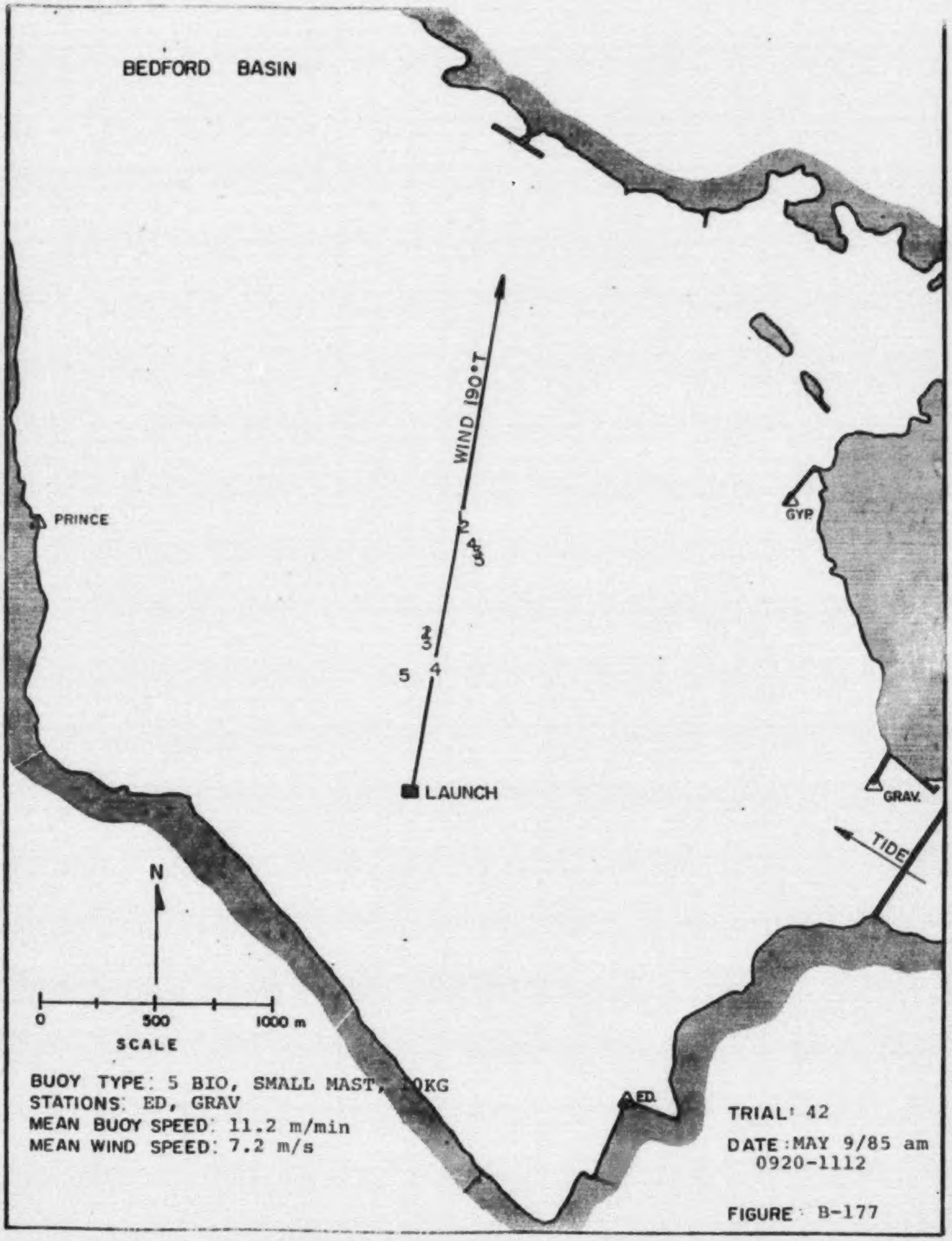
FIGURE B-175


BEDFORD BASIN
WIND 190° T
5
4 1
3
2
3
4
5
2
LAUNCH
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, NO MAST, 20
STATIONS: ED, GRAV
MEAN BUOY SPEED: 10 m/min
MEAN WIND SPEED: 7.2 m/s

TRIAL: 42
DATE: MAY 9/85 am
0920-1112

FIGURE: B-176

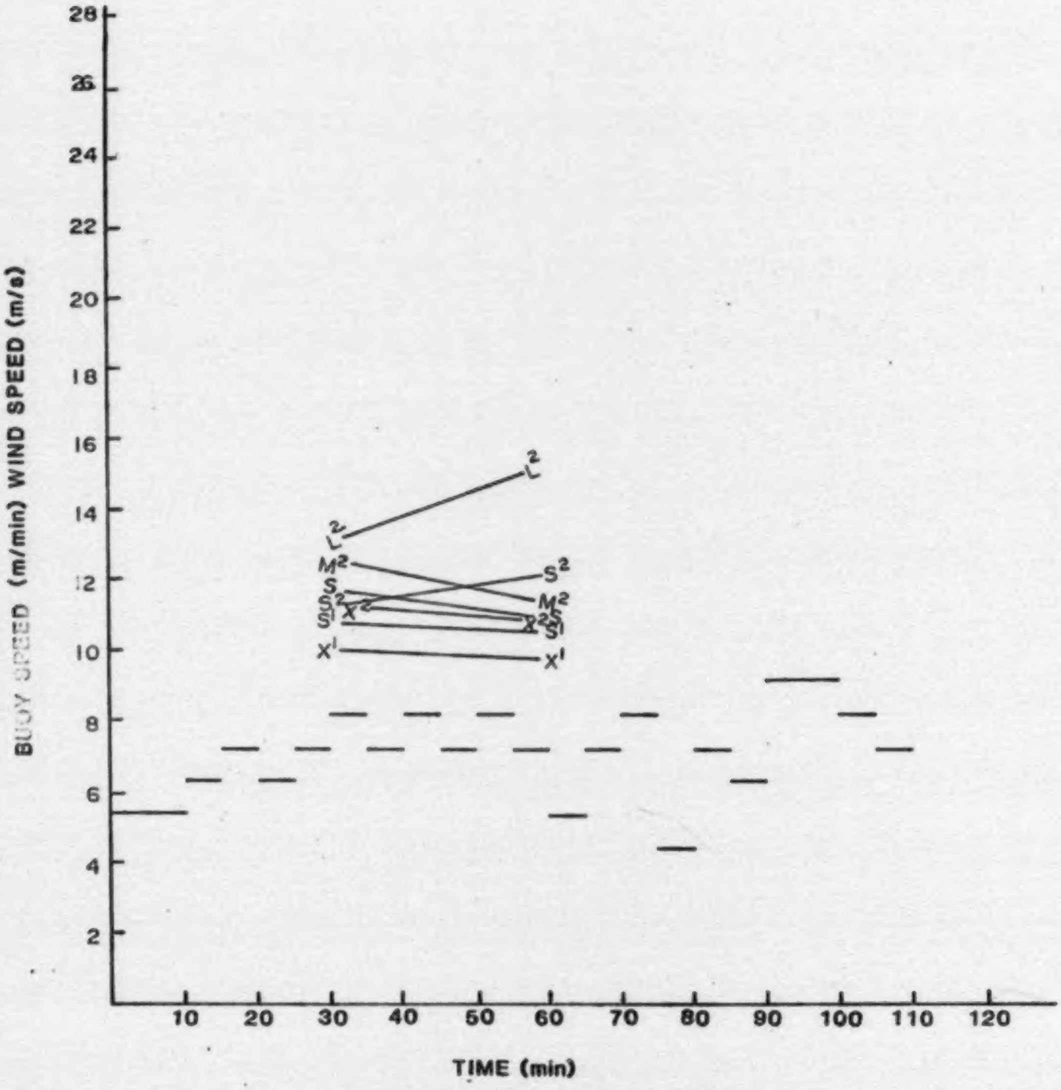

BEDFORD BASIN
WIND 190°T
2
4
3
2
3
5
4
LAUNCH
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, SMALL MAST, 10KG
STATIONS: ED, GRAV
MEAN BUOY SPEED: 11.2 m/min
MEAN WIND SPEED: 7.2 m/s

TRIAL: 42

DATE: MAY 9/85 am
0920-1112

FIGURE: B-177



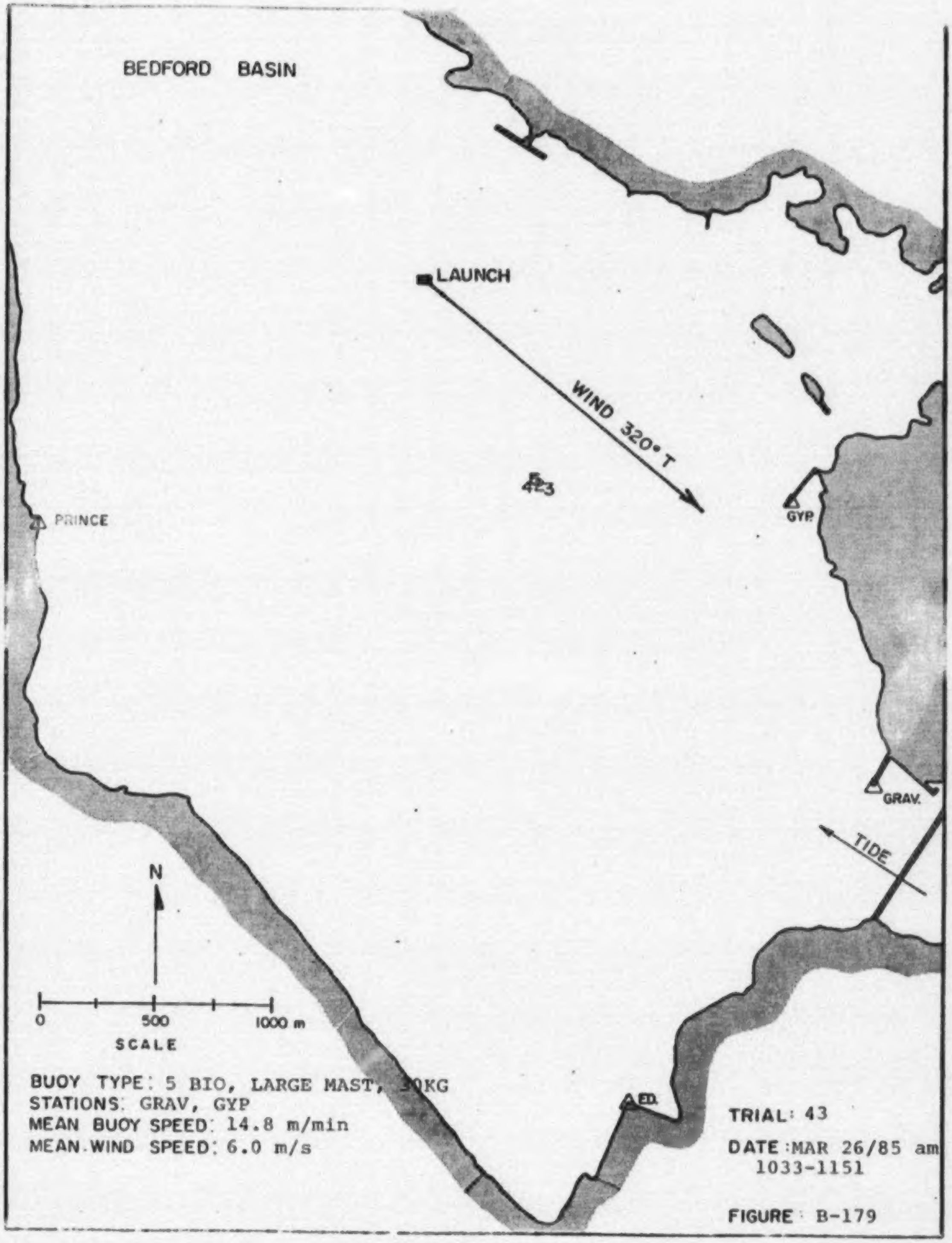
BUOY SPEED (ABSOLUTE, AT
TIME BETWEEN FIXES) Vs TIME (ELAPSED)

LEGEND

L² - BIO, LARGE MAST, 30KG
M² - BIO, MED. MAST, 30KG
S² - BIO, SMALL MAST, 30KG
S' - BIO, SMALL MAST, 20KG
S - BIO, SMALL MAST, 10KG
X² - BIO, NO MAST, 30KG
X' - BIO, NO MAST, 20KG
---- WIND

TRIAL : 42
DATE : MAY 9/85 am
TIDE :

AV. WIND SPEED : 7.2 m/s
FIGURE : B-178

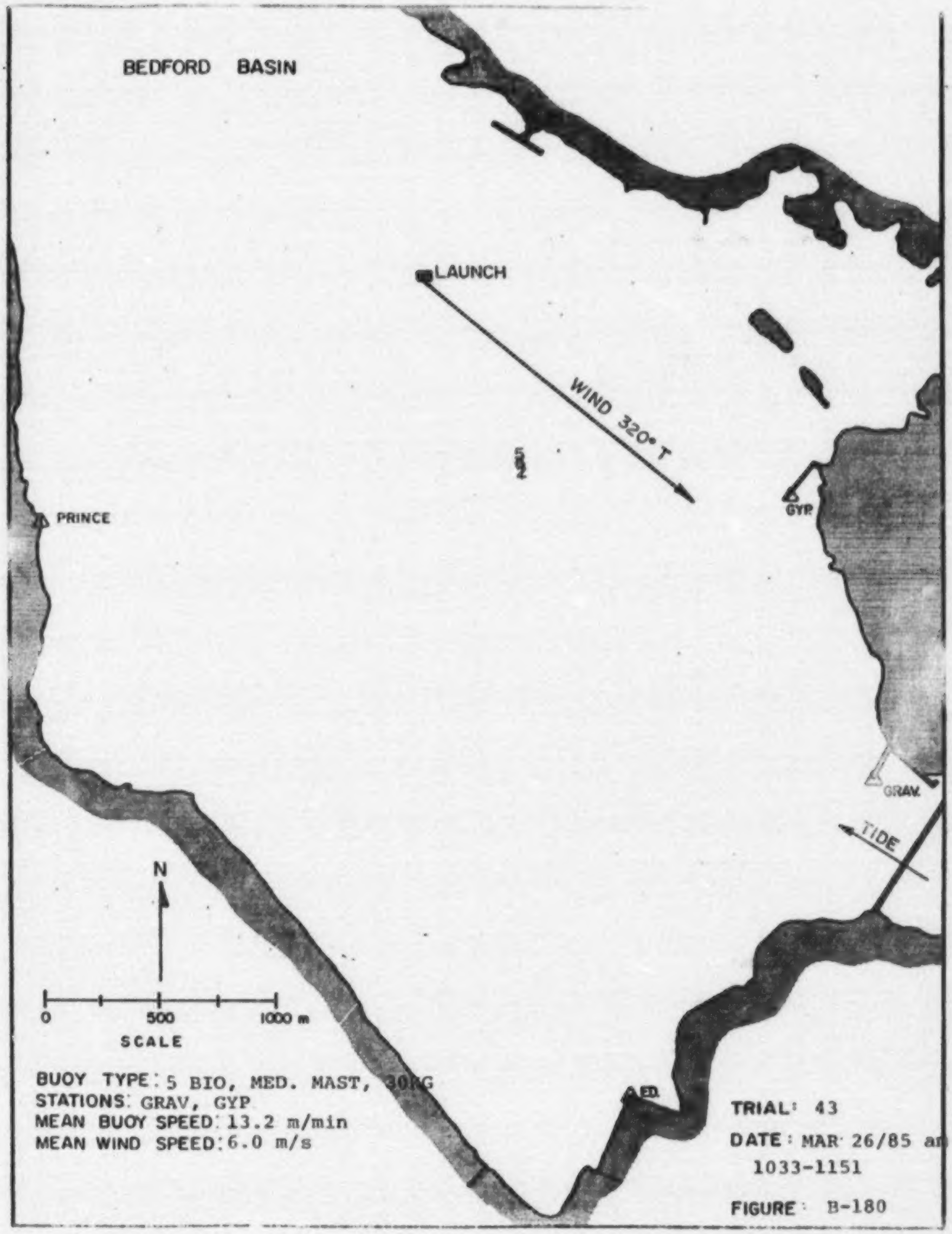

BEDFORD BASIN
LAUNCH
WIND 320° T
43
PRINCE
GYP
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, LARGE MAST, 30KG
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 14.8 m/min
MEAN WIND SPEED: 6.0 m/s

TRIAL: 43

DATE: MAR 26/85 am
1033-1151

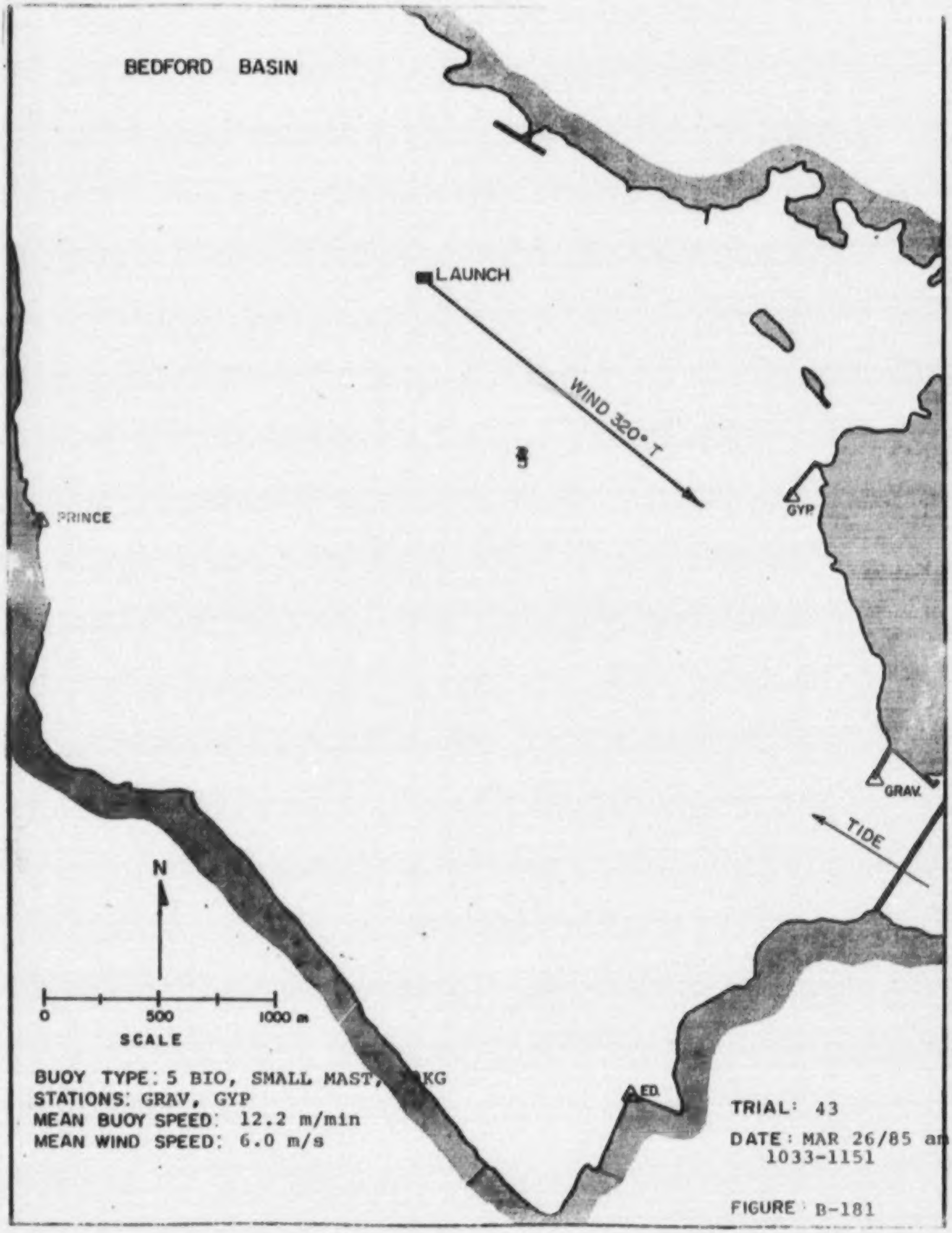
FIGURE: B-179


BEDFORD BASIN
LAUNCH
WIND 320° T
5
8
2
PRINCE
GYP.
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, MED. MAST, 30KG
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 13.2 m/min
MEAN WIND SPEED: 6.0 m/s

TRIAL: 43
DATE: MAR 26/85 a
1033-1151

FIGURE: B-180

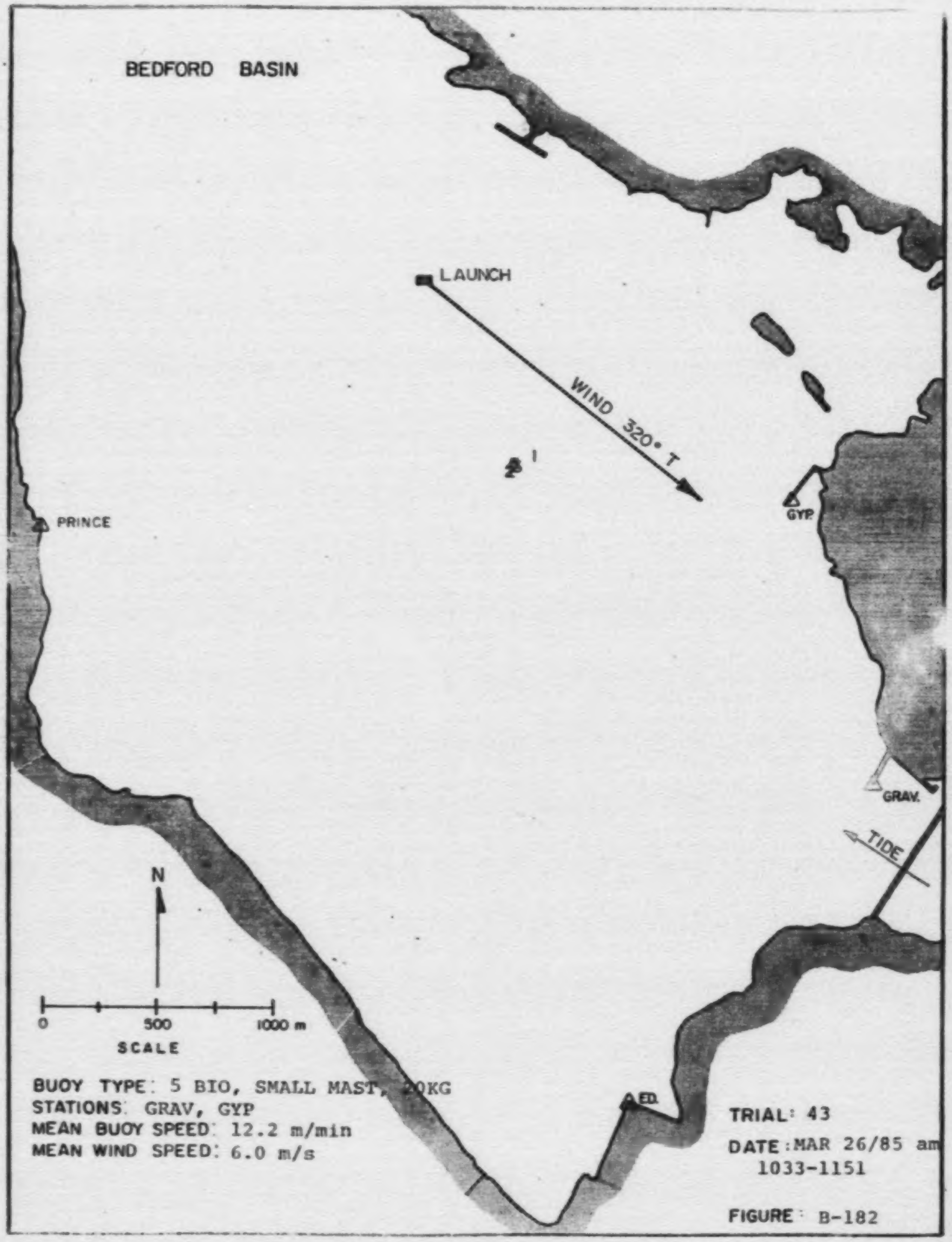

BEDFORD BASIN
LAUNCH
WIND 320° T
5
PRINCE
GYP
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, SMALL MAST, [illegible]KG
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 12.2 m/min
MEAN WIND SPEED: 6.0 m/s

TRIAL: 43

DATE: MAR 26/85 am
1033-1151

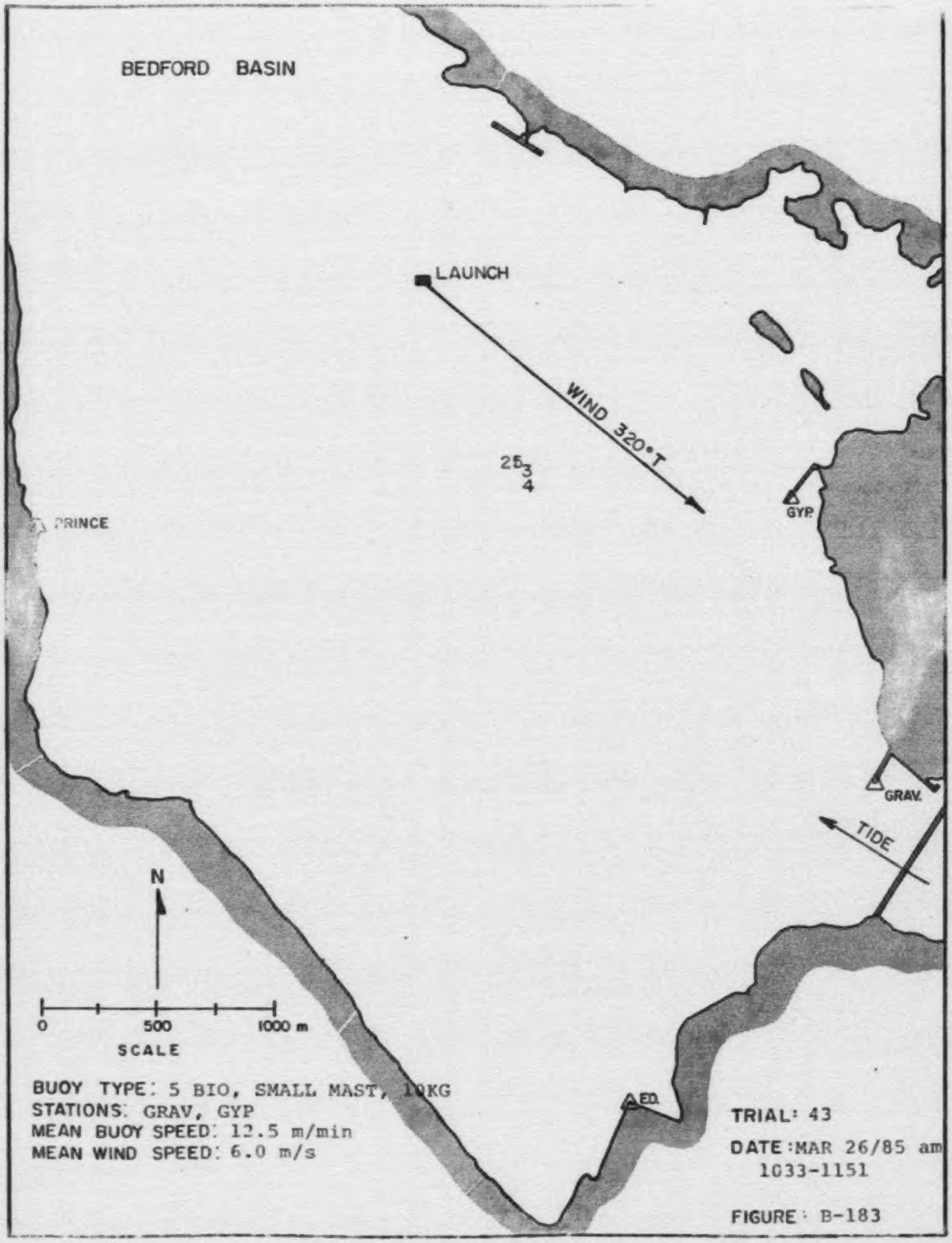
FIGURE B-181


BEDFORD BASIN
LAUNCH
WIND 320° T
1
2
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, SMALL MAST, 20KG
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 12.2 m/min
MEAN WIND SPEED: 6.0 m/s

TRIAL: 43
DATE: MAR 26/85 am
1033-1151

FIGURE: B-182

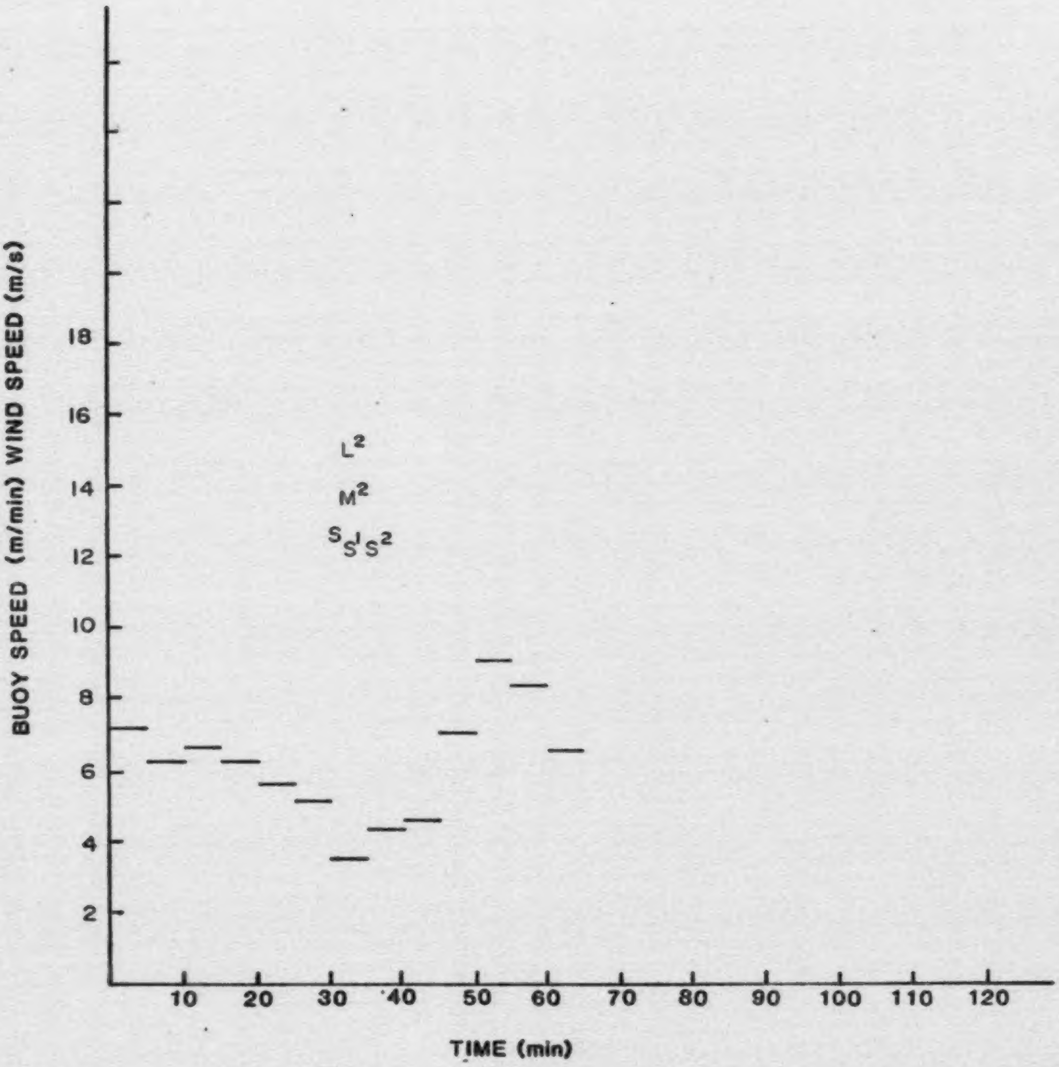

BEDFORD BASIN
LAUNCH
WIND 320°T
25
3
4
PRINCE
GYP.
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, SMALL MAST, 10KG
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 12.5 m/min
MEAN WIND SPEED: 6.0 m/s

TRIAL: 43

DATE: MAR 26/85 am
1033-1151

FIGURE: B-183

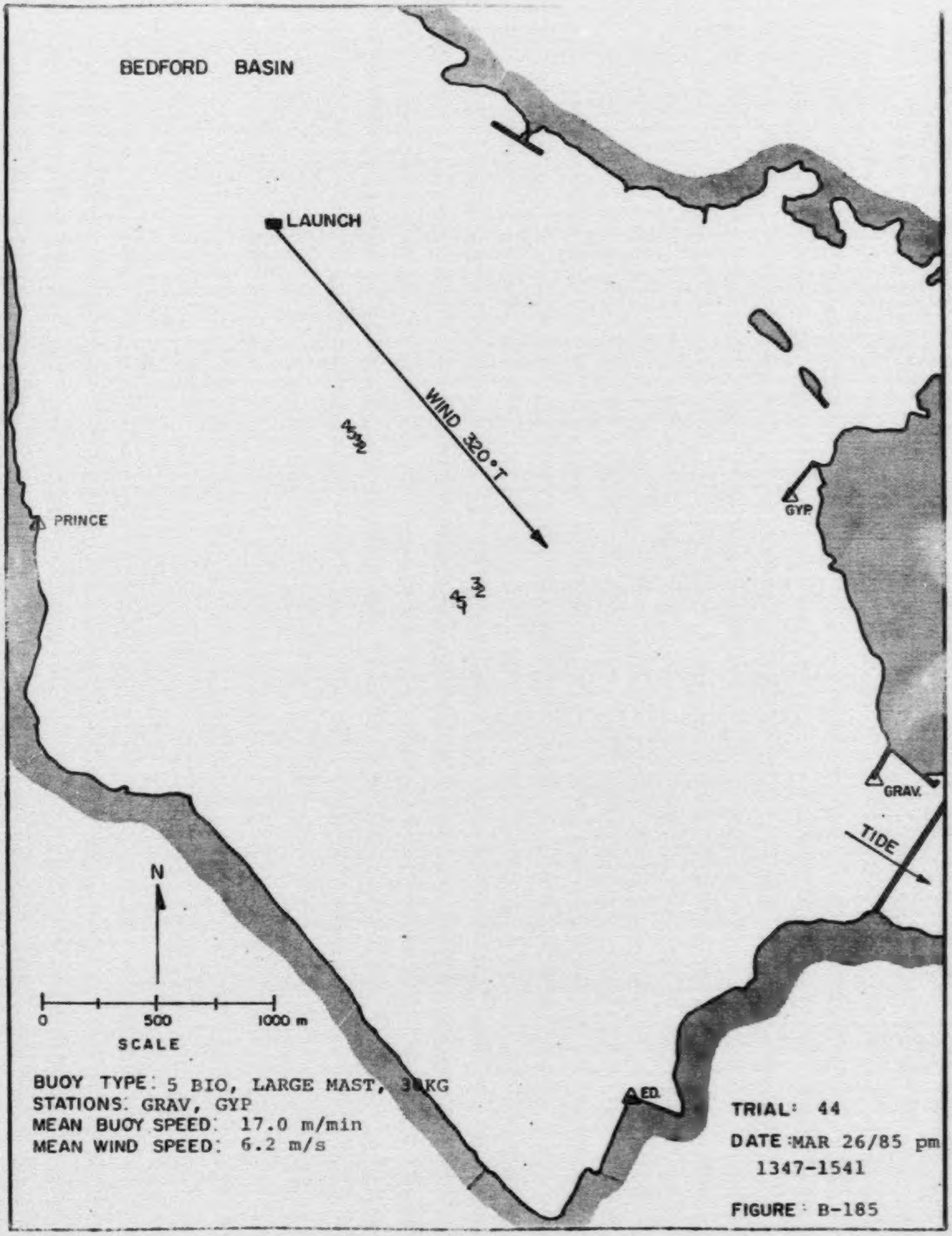


BUOY SPEED (ABSOLUTE, AT
TIME BETWEEN FIXES) Vs TIME (ELAPSED)

LEGEND

L² - BIO, LARGE MAST, 30KG
M² - BIO, MEDIUM MAST, 30KG
S² - BIO, SMALL MAST, 30KG
S¹ - BIO, SMALL MAST, 20KG
S - BIO, SMALL MAST, 10KG
-- - WIND

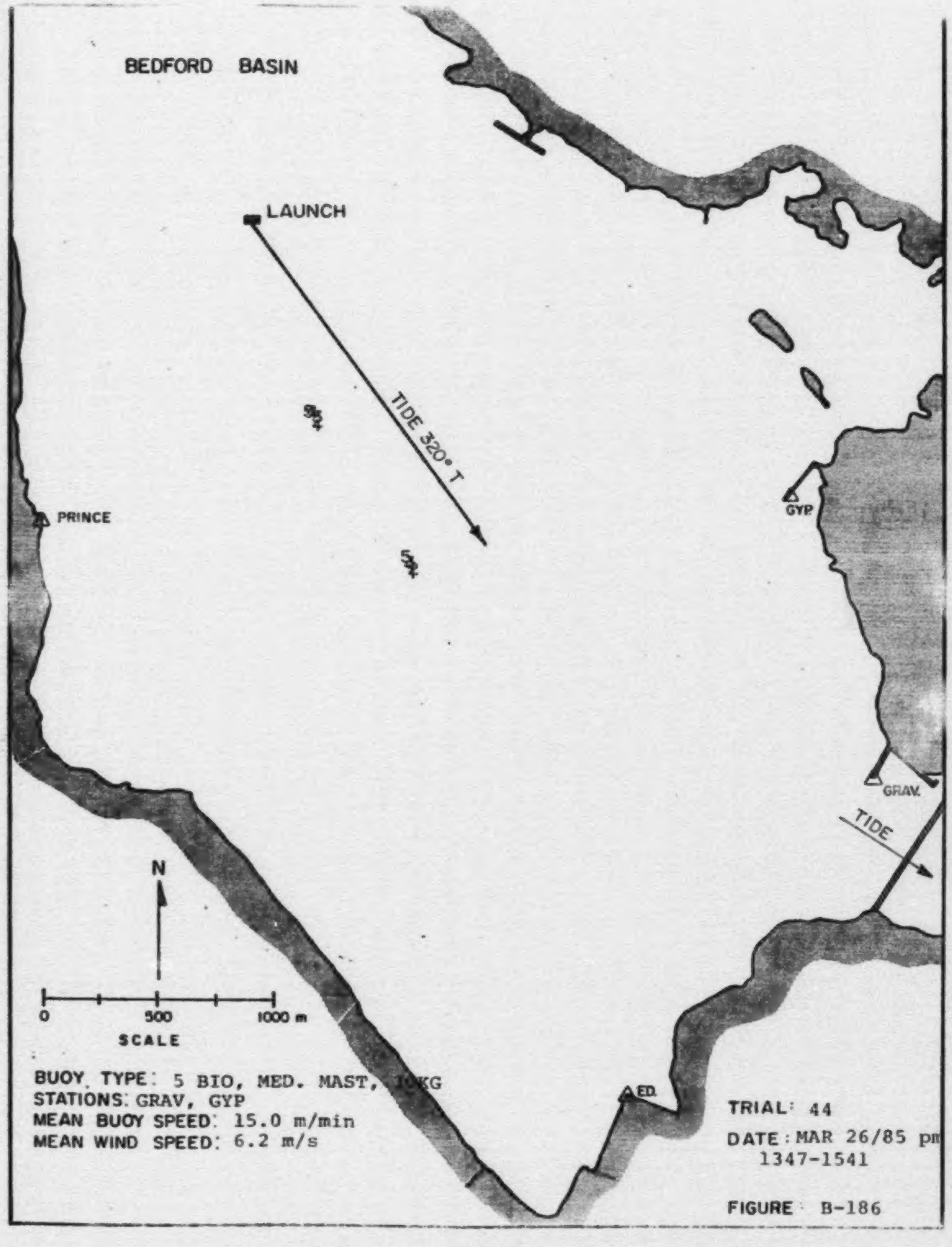
TRIAL : 43
DATE : MAR 26/85 1033-1151
TIDE : LOW - 0455
HI - 1105
AV. WIND SPEED : 6.0 m/s
FIGURE : B-184


BEDFORD BASIN
LAUNCH
WIND 320°T
4 3 2
PRINCE
GYP.
3 2
4 5 1
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, LARGE MAST, 30KG
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 17.0 m/min
MEAN WIND SPEED: 6.2 m/s

TRIAL: 44
DATE: MAR 26/85 pm
1347-1541

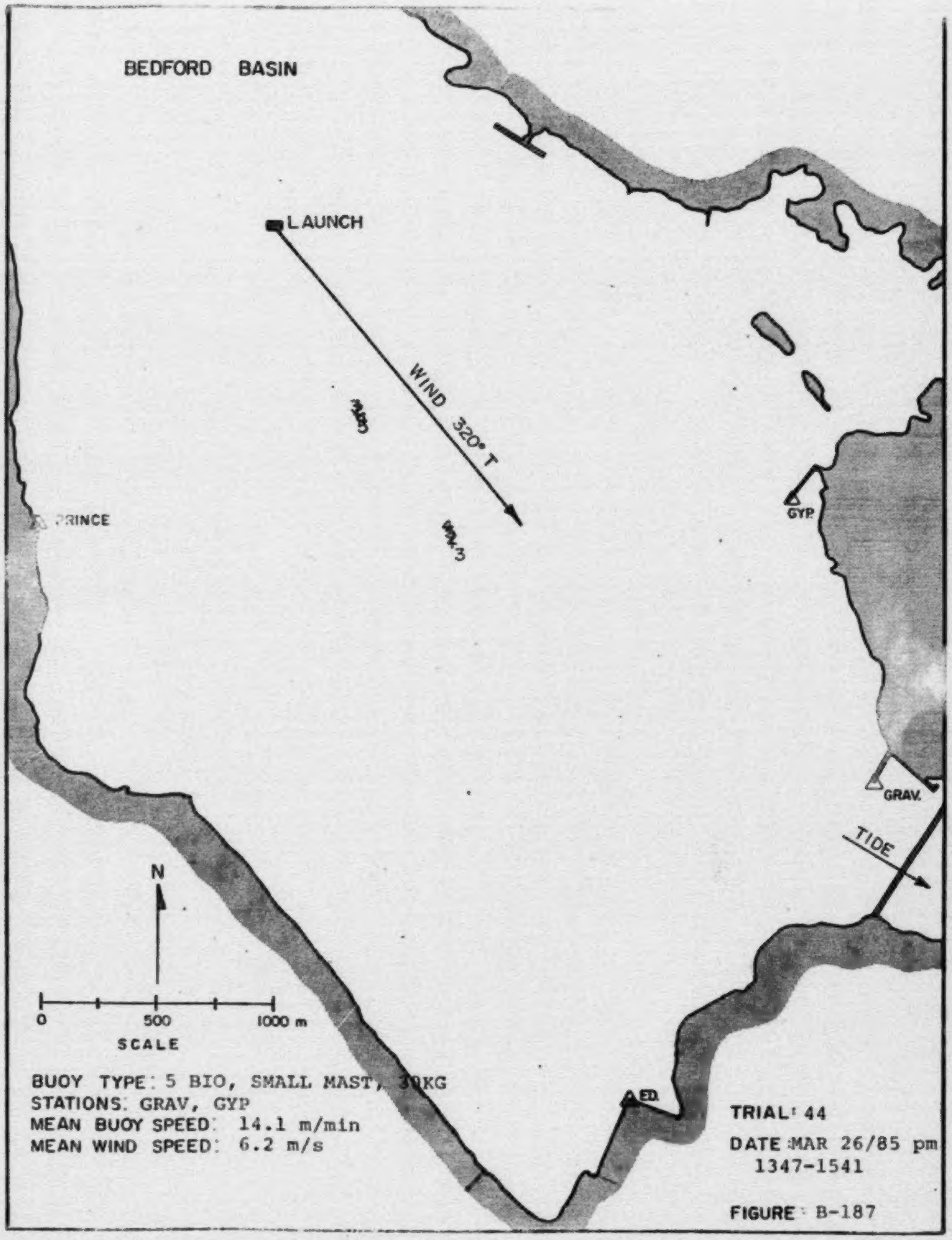
FIGURE: B-185


BEDFORD BASIN
LAUNCH
TIDE 320° T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, MED. MAST, 10KG
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 15.0 m/min
MEAN WIND SPEED: 6.2 m/s

TRIAL: 44
DATE: MAR 26/85 pm
1347-1541

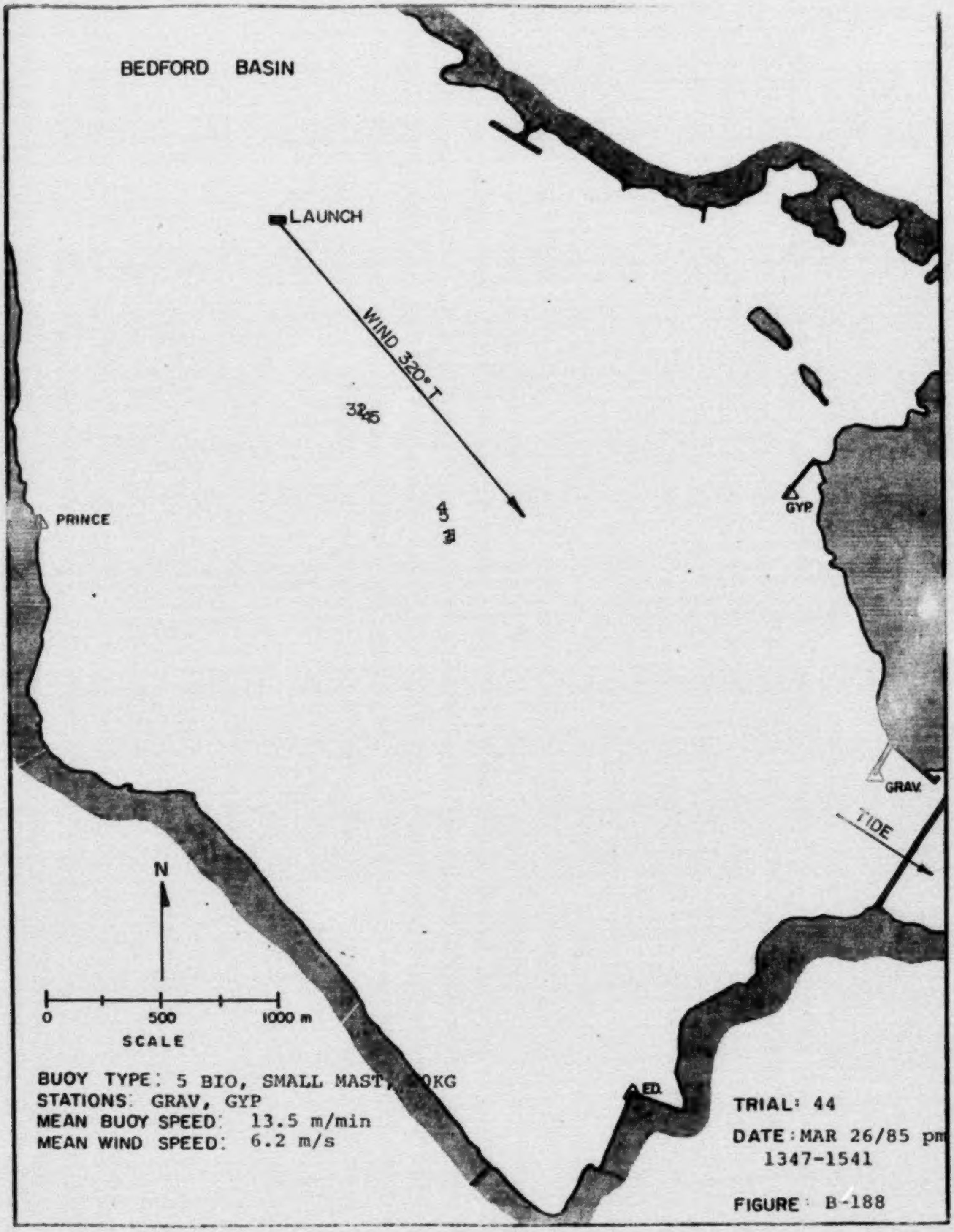
FIGURE B-186


BEDFORD BASIN
LAUNCH
WIND 320° T
3
PRINCE
GYP.
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, SMALL MAST, 30KG
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 14.1 m/min
MEAN WIND SPEED: 6.2 m/s

TRIAL: 44
DATE: MAR 26/85 pm
1347-1541

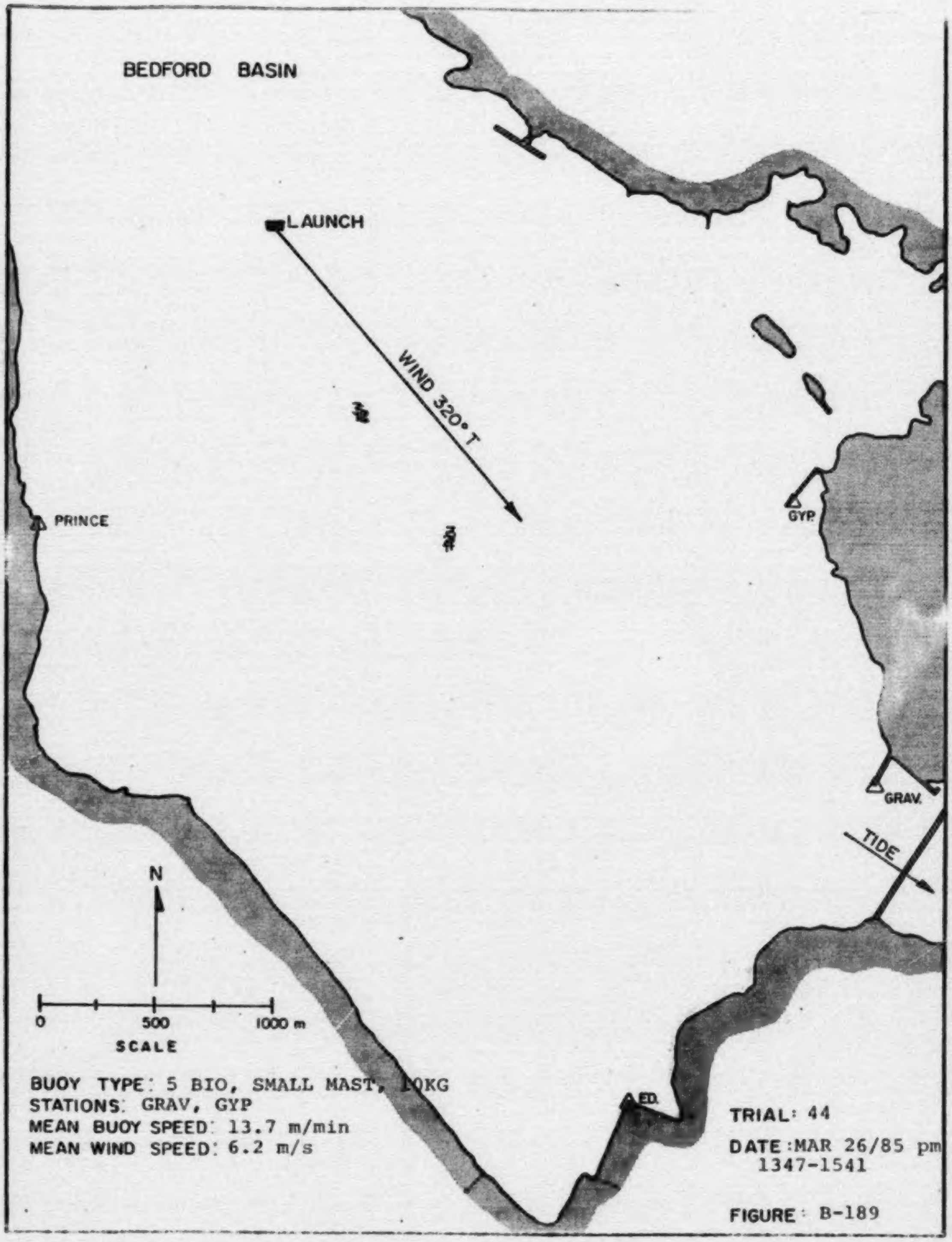
FIGURE: B-187


BEDFORD BASIN
LAUNCH
WIND 320° T
3245
4
5
3
PRINCE
GYP.
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, SMALL MAST, [illegible]0KG
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 13.5 m/min
MEAN WIND SPEED: 6.2 m/s

TRIAL: 44
DATE: MAR 26/85 pm
1347-1541

FIGURE: B-188

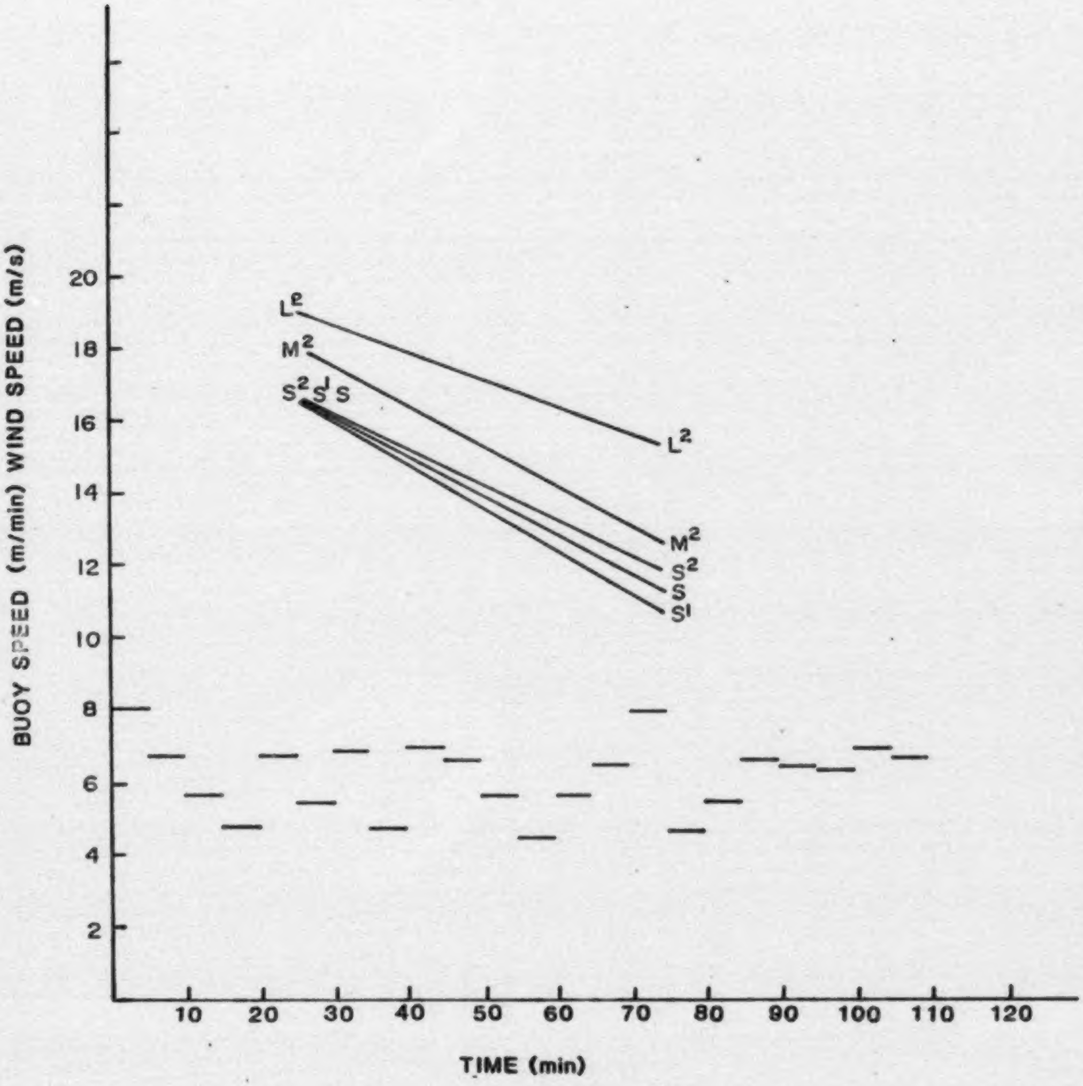

BEDFORD BASIN
LAUNCH
WIND 320° T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, SMALL MAST, 10KG
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 13.7 m/min
MEAN WIND SPEED: 6.2 m/s

TRIAL: 44

DATE: MAR 26/85 pm
1347-1541

FIGURE: B-189



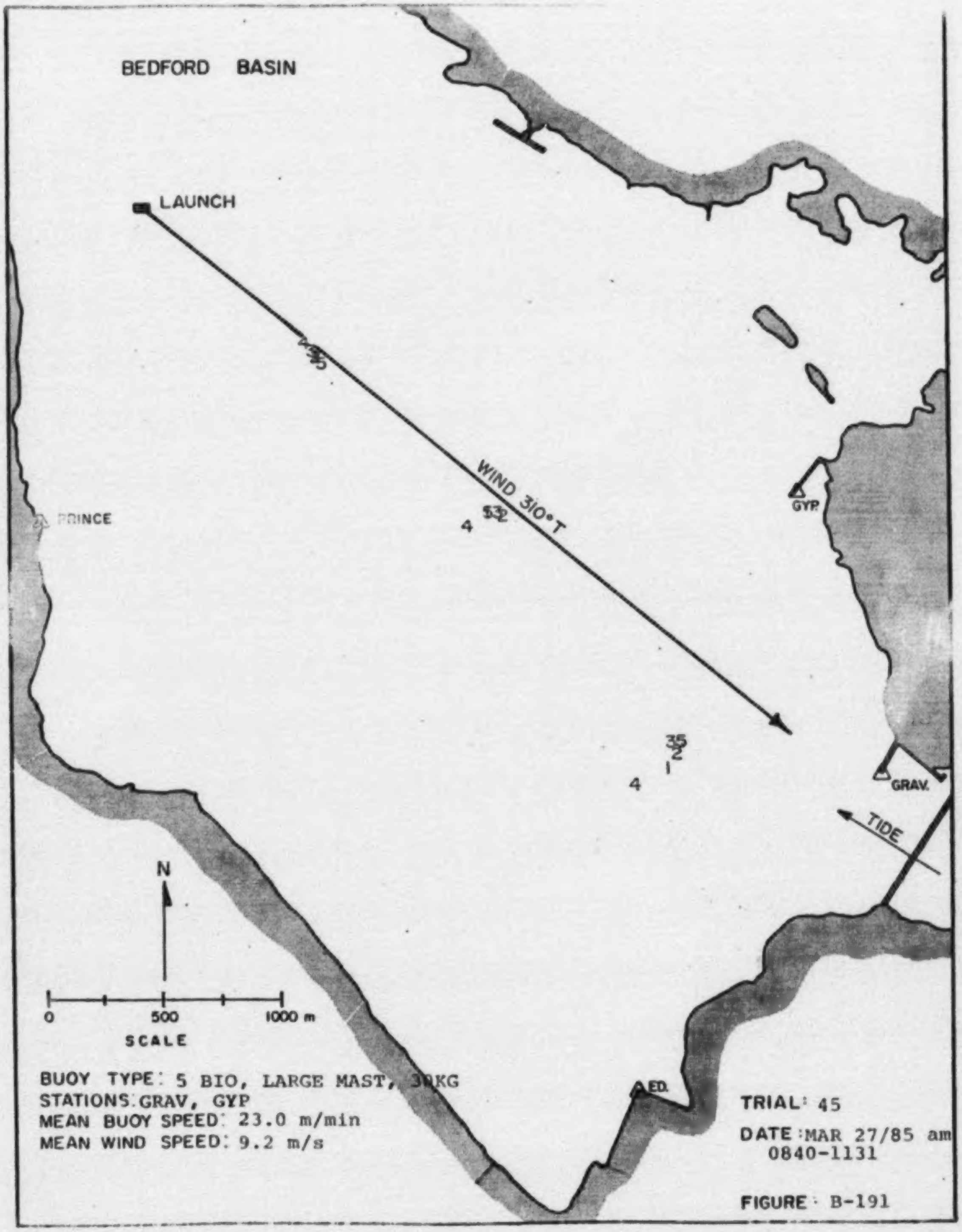
BUOY SPEED (ABSOLUTE, AT TIME BETWEEN FIXES) Vs TIME (ELAPSED)

LEGEND

L² - BIO, LARGE MAST, 30KG
M² - BIO, MED. MAST, 30KG
S² - BIO, SMALL MAST, 30KG
S' - BIO, SMALL MAST, 20KG
S - BIO, SMALL MAST, 10KG
-- - WIND

TRIAL : 44
DATE : MAR 26/85 1347-1541
TIDE : HI - 1105
LOW - 1655

AV. WIND SPEED : 6.2 m/s
FIGURE : B-190

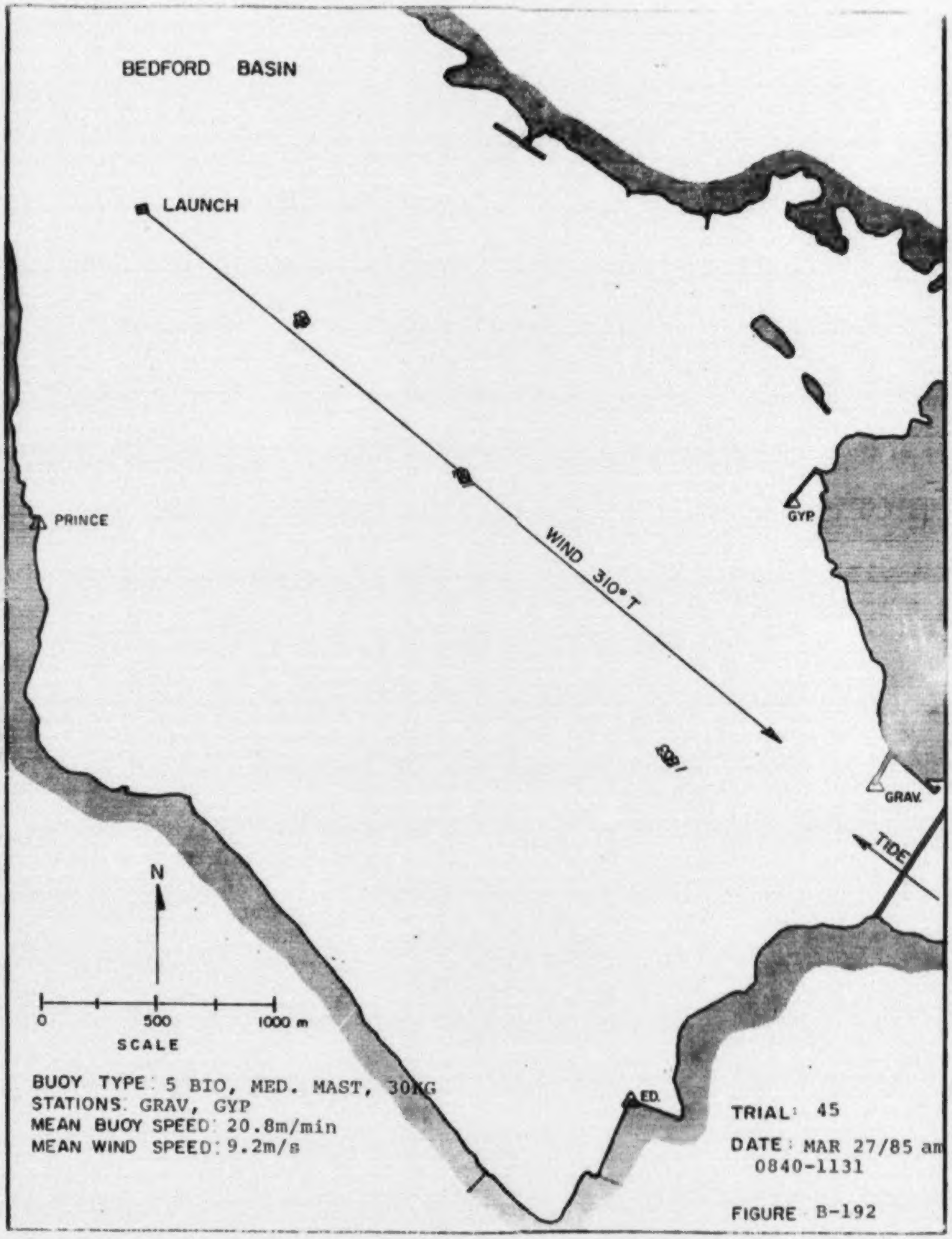

BEDFORD BASIN
LAUNCH
WIND
WIND 310°T
5
3
2
4
PRINCE
GYP.
35
2
1
4
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, LARGE MAST, 30KG
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 23.0 m/min
MEAN WIND SPEED: 9.2 m/s

TRIAL: 45

DATE: MAR 27/85 am
0840-1131

FIGURE: B-191

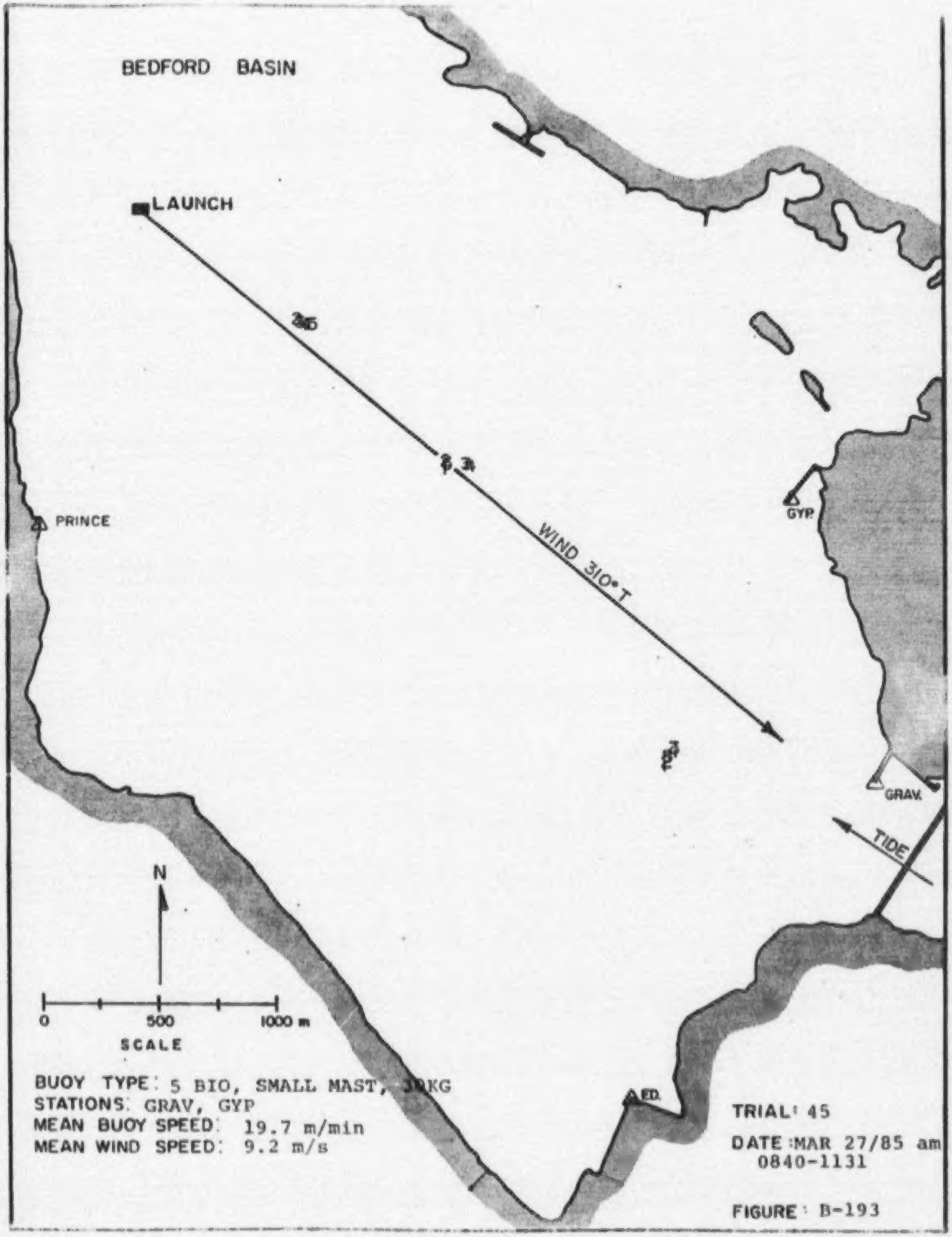

BEDFORD BASIN
LAUNCH
PRINCE
GYP
WIND 310° T
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, MED. MAST, 30KG
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 20.8m/min
MEAN WIND SPEED: 9.2m/s

TRIAL: 45

DATE: MAR 27/85 am
0840-1131

FIGURE B-192

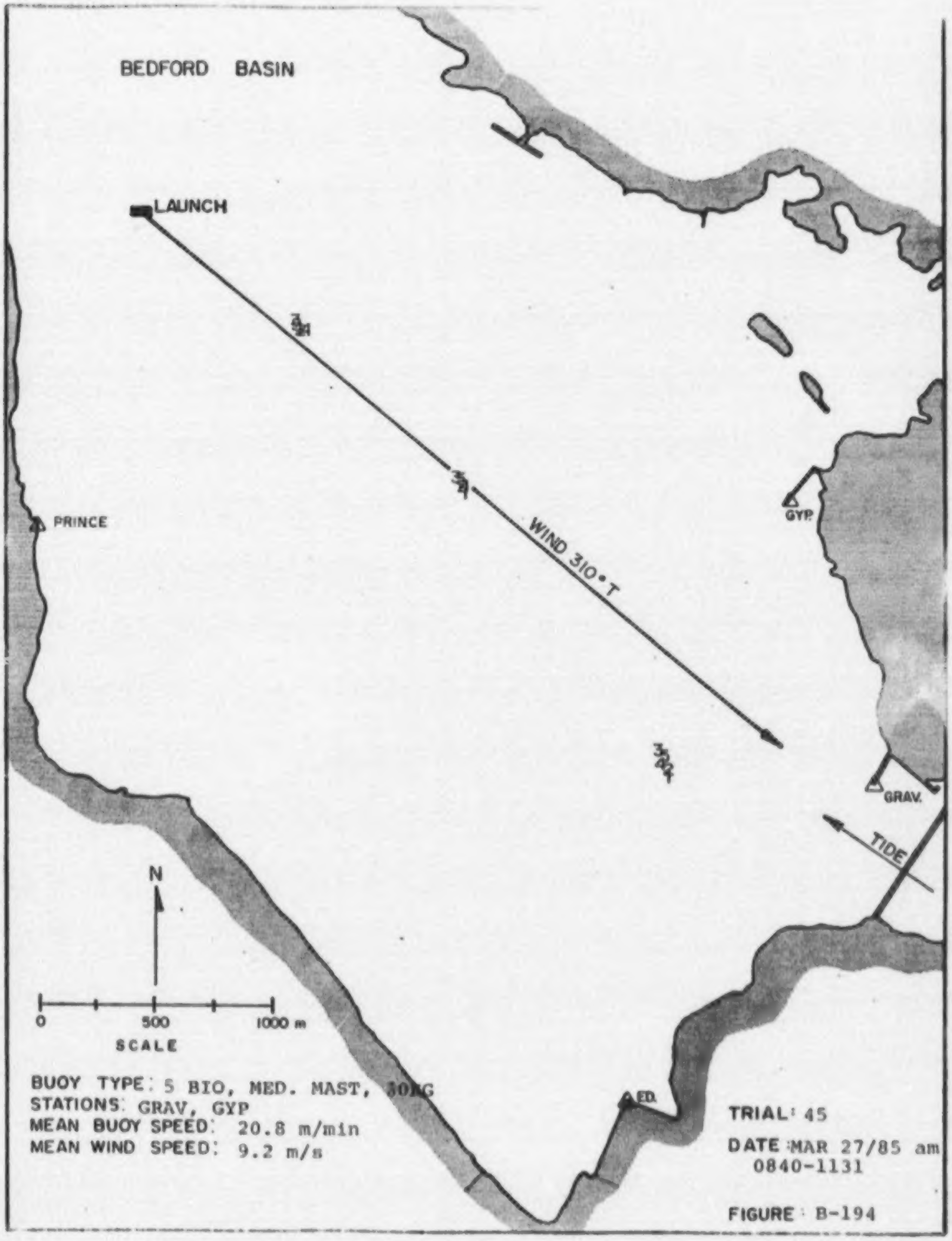

BEDFORD BASIN
LAUNCH
WIND 310° T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, SMALL MAST, 30KG
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 19.7 m/min
MEAN WIND SPEED: 9.2 m/s

TRIAL: 45

DATE: MAR 27/85 am
0840-1131

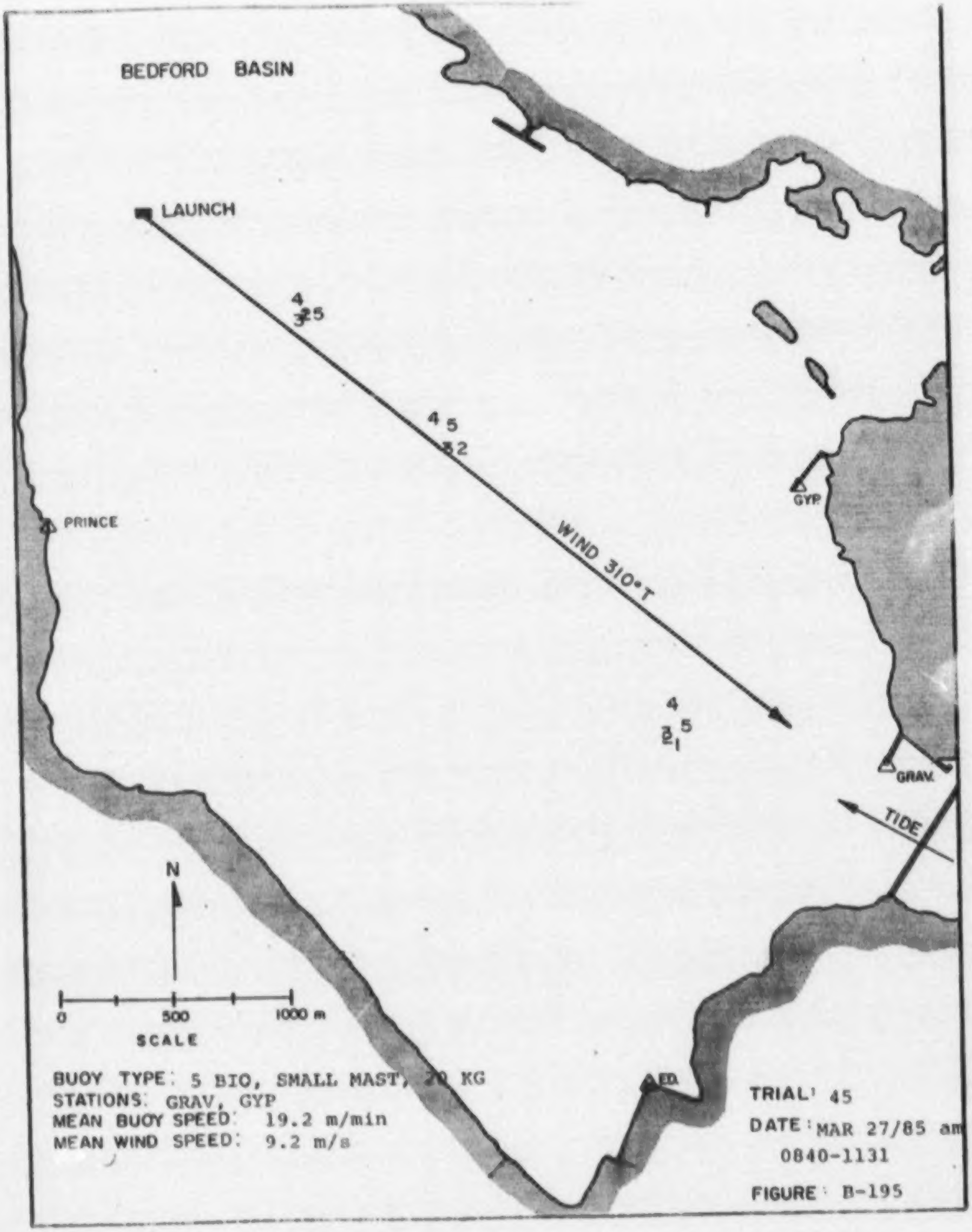
FIGURE: B-193


BEDFORD BASIN
LAUNCH
WIND 310°T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, MED. MAST, 30KG
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 20.8 m/min
MEAN WIND SPEED: 9.2 m/s

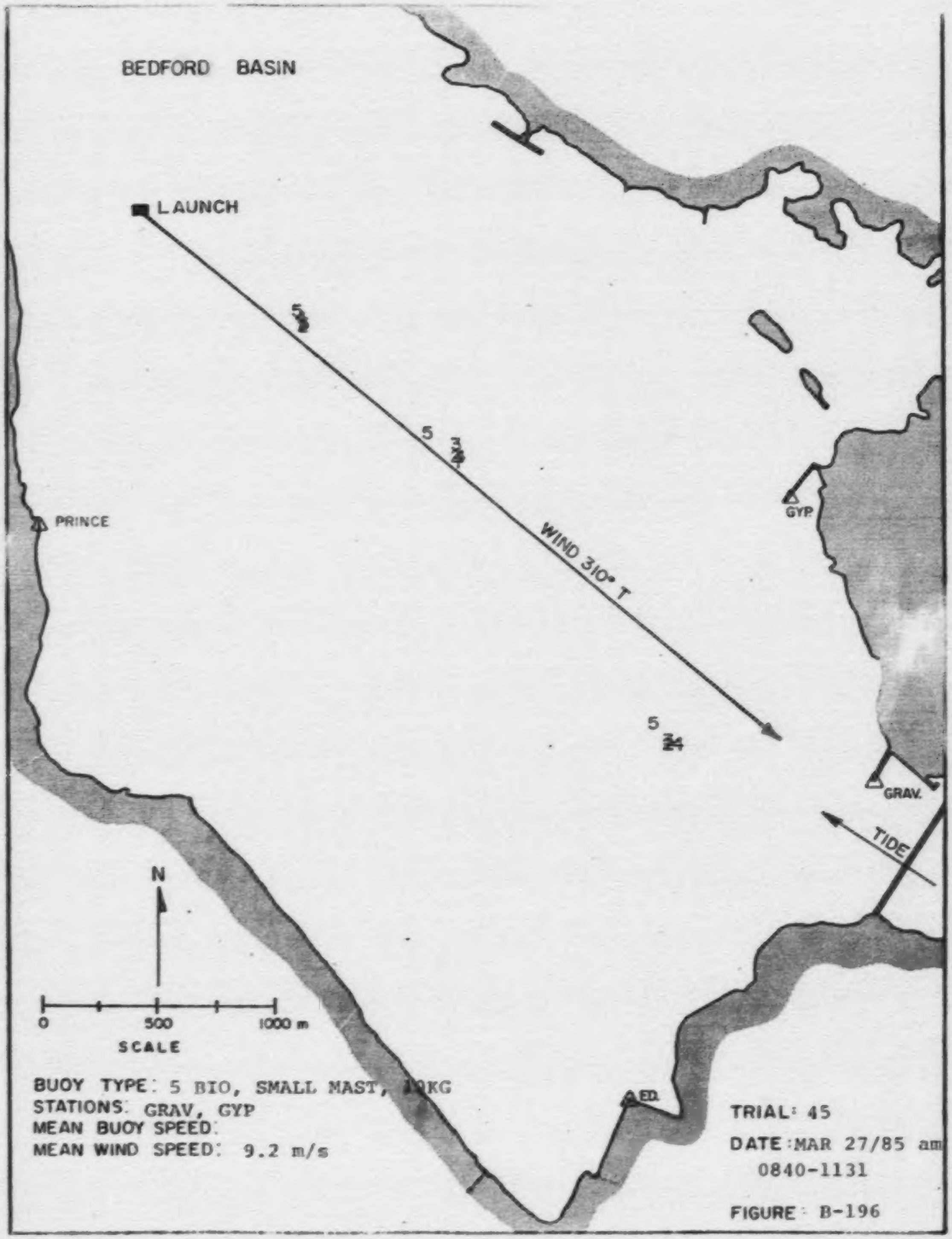
TRIAL: 45
DATE: MAR 27/85 am
0840-1131

FIGURE: B-194


BEDFORD BASIN
LAUNCH
4
3 2 5
4 5
3 2
WIND 310°T
PRINCE
GYP.
4
3 5
2
1
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, SMALL MAST, 20 KG
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 19.2 m/min
MEAN WIND SPEED: 9.2 m/s

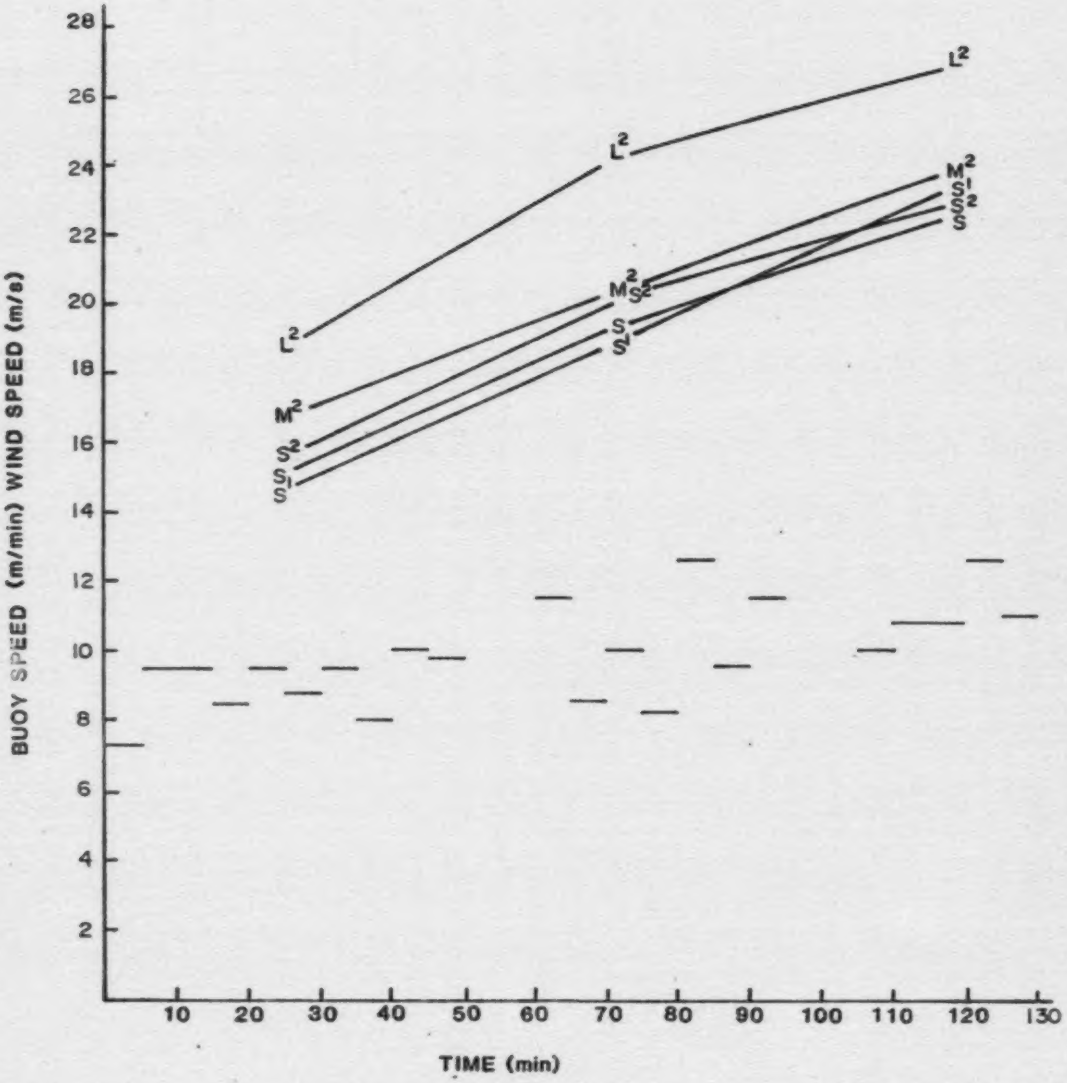
TRIAL: 45
DATE: MAR 27/85 am
0840-1131
FIGURE: B-195


BEDFORD BASIN
LAUNCH
5
3
5
3
4
WIND 310° T
PRINCE
GYP.
5
3
24
GRAV.
TIDE
N
0
500
1000 m
SCALE
ED.

BUOY TYPE: 5 BIO, SMALL MAST, 10KG
STATIONS: GRAV, GYP
MEAN BUOY SPEED:
MEAN WIND SPEED: 9.2 m/s

TRIAL: 45
DATE: MAR 27/85 am
0840-1131

FIGURE: B-196

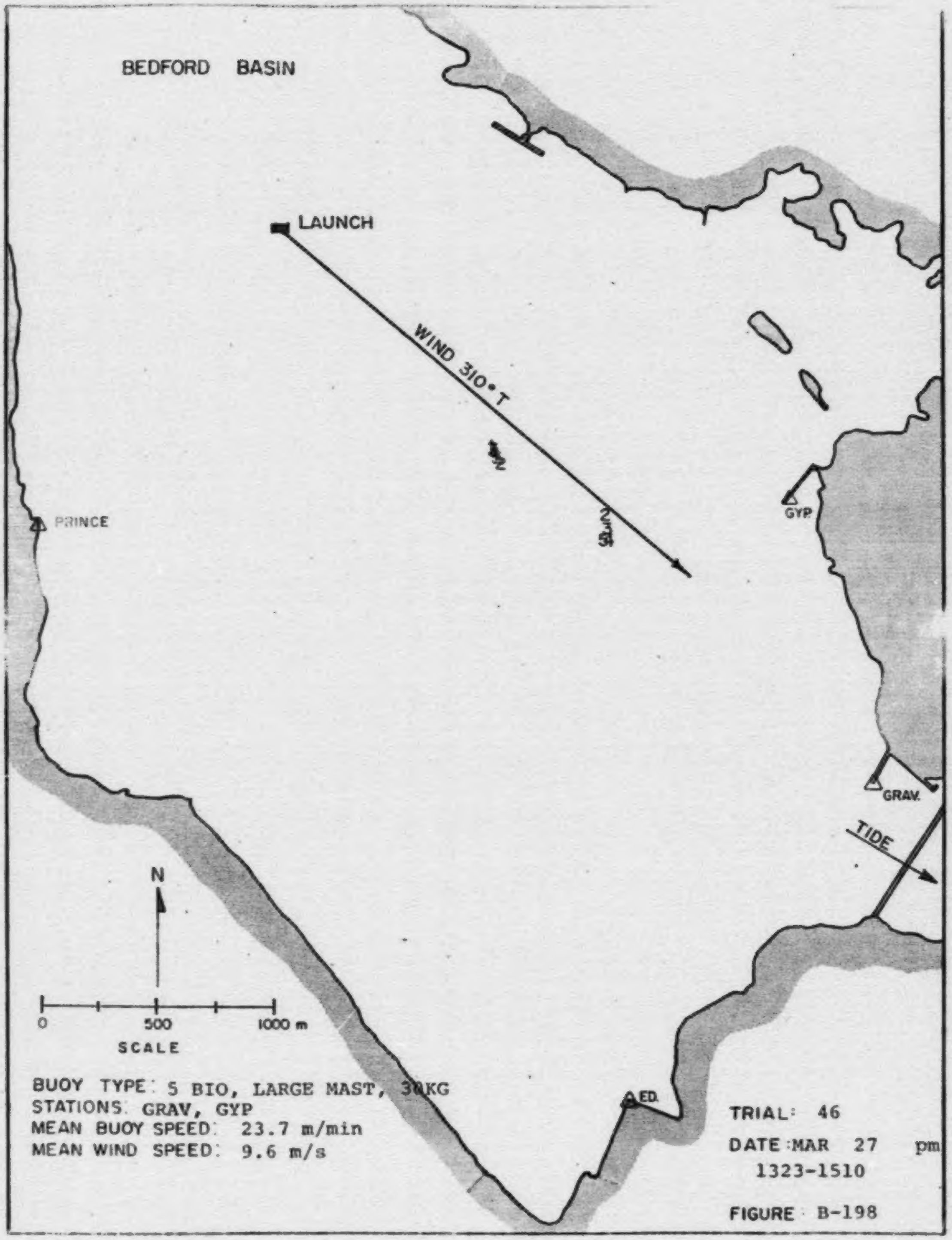


BUOY SPEED (ABSOLUTE, AT TIME BETWEEN FIXES) Vs TIME (ELAPSED)

LEGEND

L^2 - BIO, LARGE MAST, 30KG
M^2 - BIO, MED. MAST, 30KG
S^2 - BIO, SMALL MAST, 30KG
S^1 - BIO, SMALL MAST, 20KG
S - BIO, SMALL MAST, 10KG
-- - WIND

TRIAL : 45
DATE : MAR 27/85 0840-1131
TIDE : LOW - 0540
HI - 1145
AV. WIND SPEED : 9.2 m/s
FIGURE : B-197

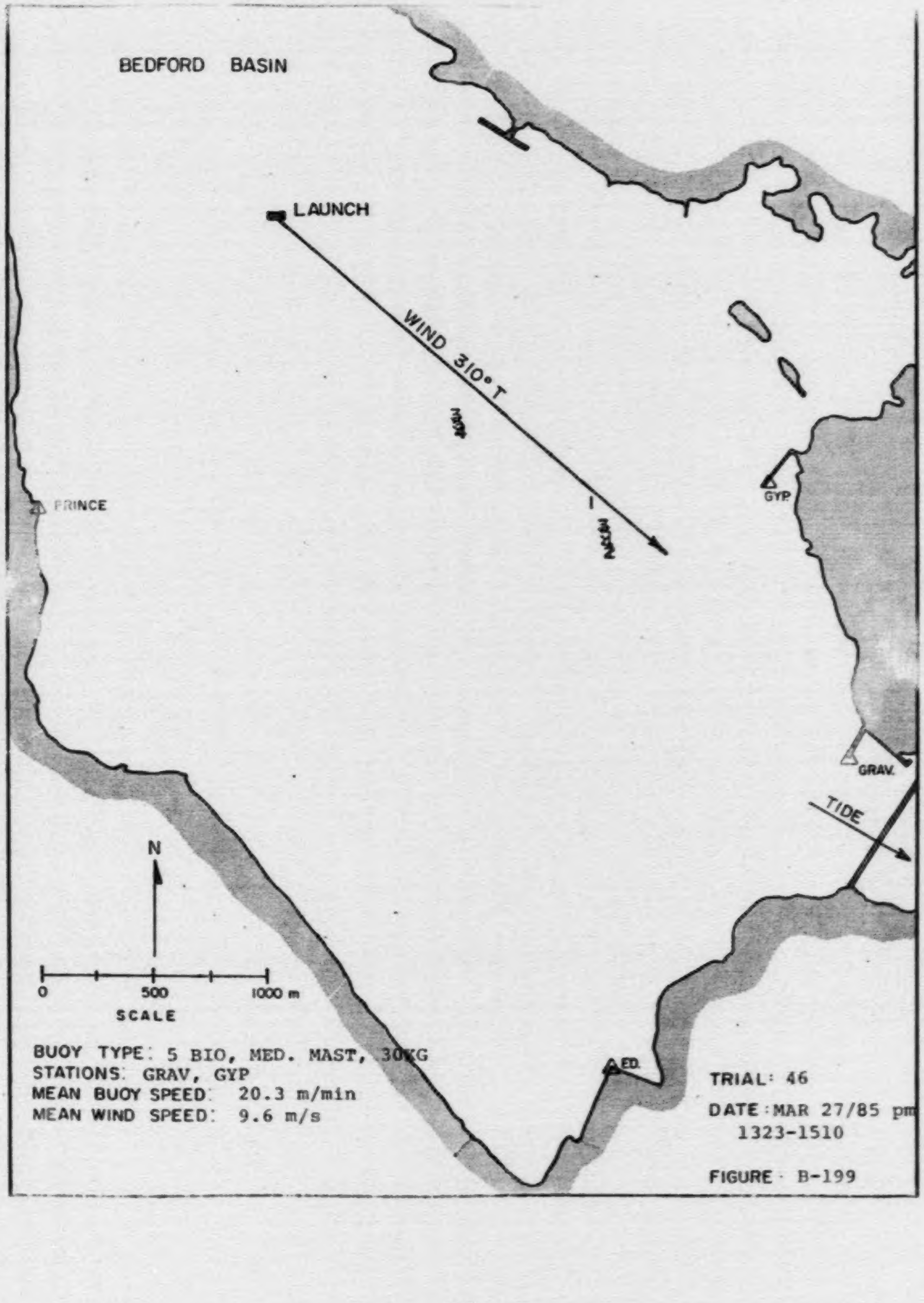


BEDFORD BASIN
LAUNCH
WIND 310° T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, LARGE MAST, 30KG
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 23.7 m/min
MEAN WIND SPEED: 9.6 m/s

TRIAL: 46
DATE: MAR 27 pm
1323-1510

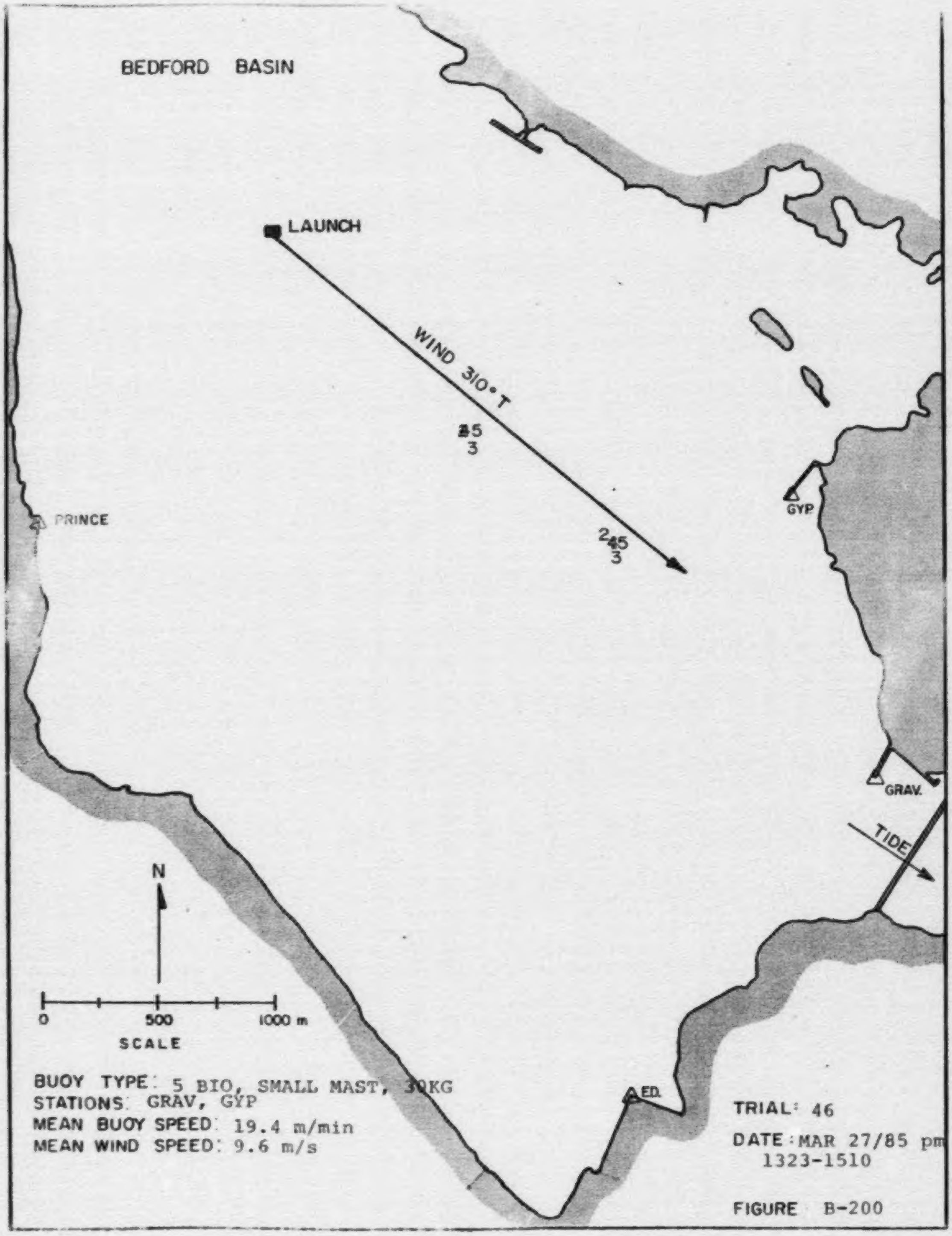
FIGURE B-198


BEDFORD BASIN
LAUNCH
WIND 310° T
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, MED. MAST, 30KG
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 20.3 m/min
MEAN WIND SPEED: 9.6 m/s

TRIAL: 46
DATE: MAR 27/85 pm
1323-1510

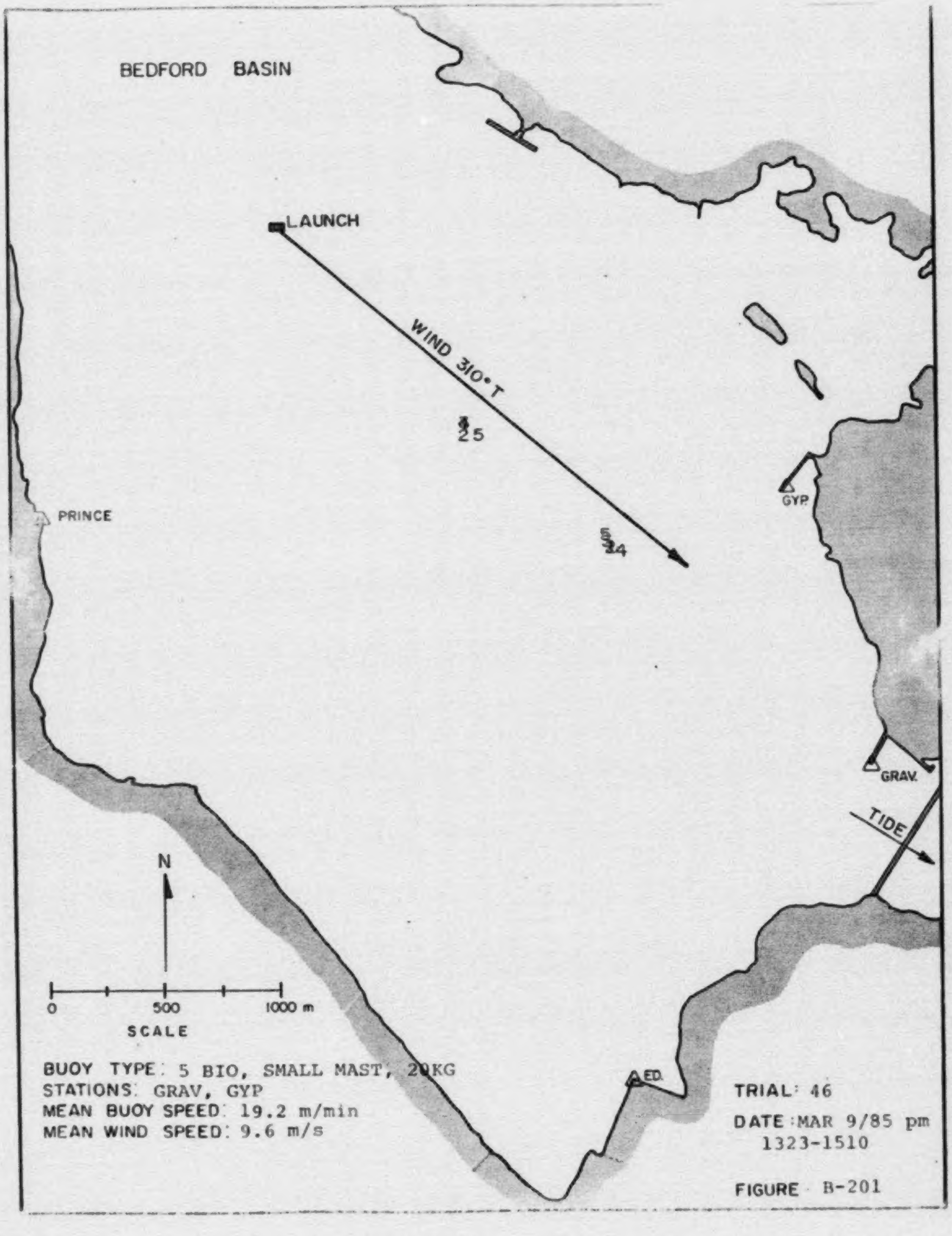
FIGURE B-199


BEDFORD BASIN
LAUNCH
WIND 310°T
25
3
245
3
PRINCE
GYP
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, SMALL MAST, 30KG
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 19.4 m/min
MEAN WIND SPEED: 9.6 m/s

TRIAL: 46
DATE: MAR 27/85 pm
1323-1510

FIGURE B-200

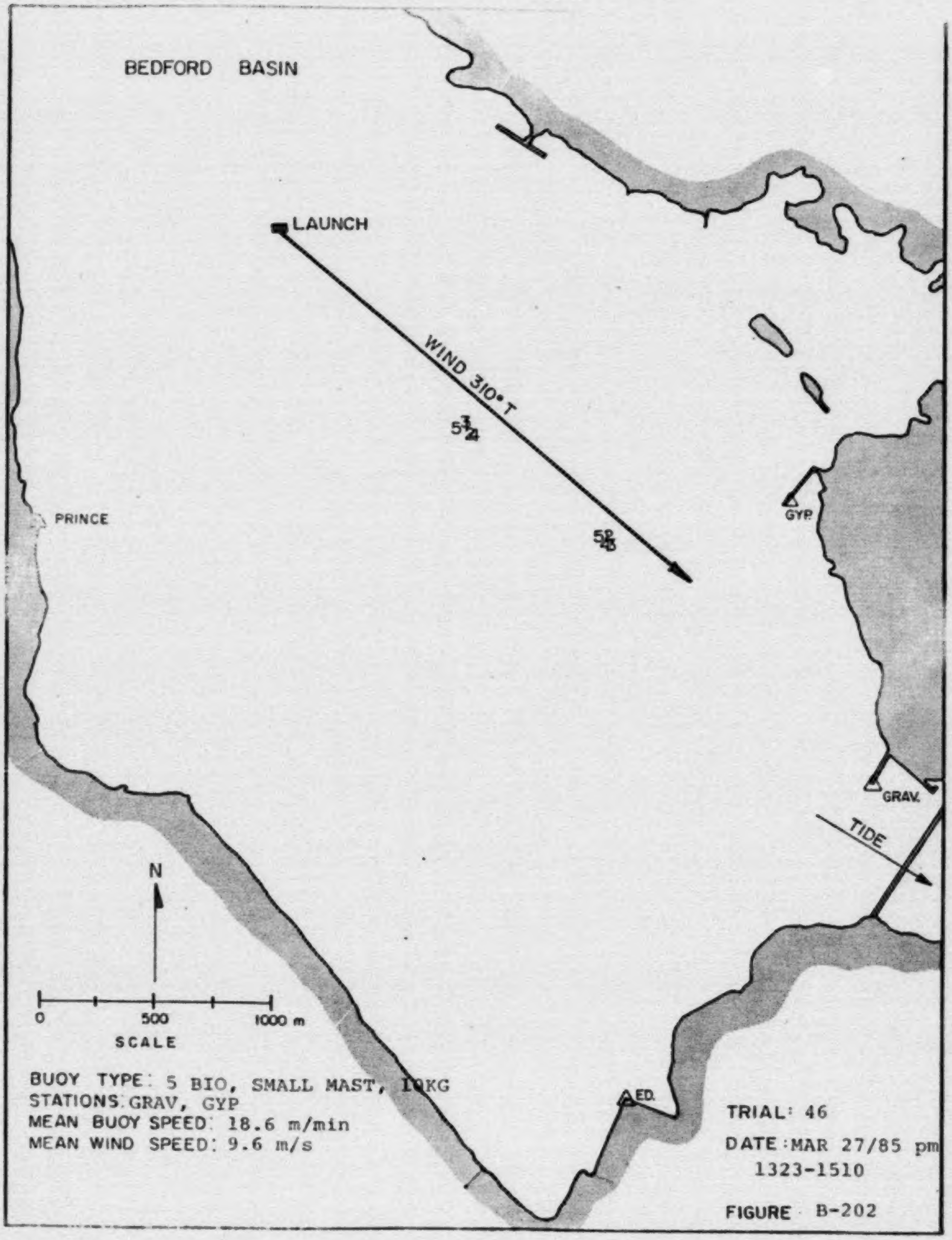

BEDFORD BASIN
LAUNCH
WIND 310°T
25
24
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, SMALL MAST, 20KG
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 19.2 m/min
MEAN WIND SPEED: 9.6 m/s

TRIAL: 46

DATE: MAR 9/85 pm
1323-1510

FIGURE B-201

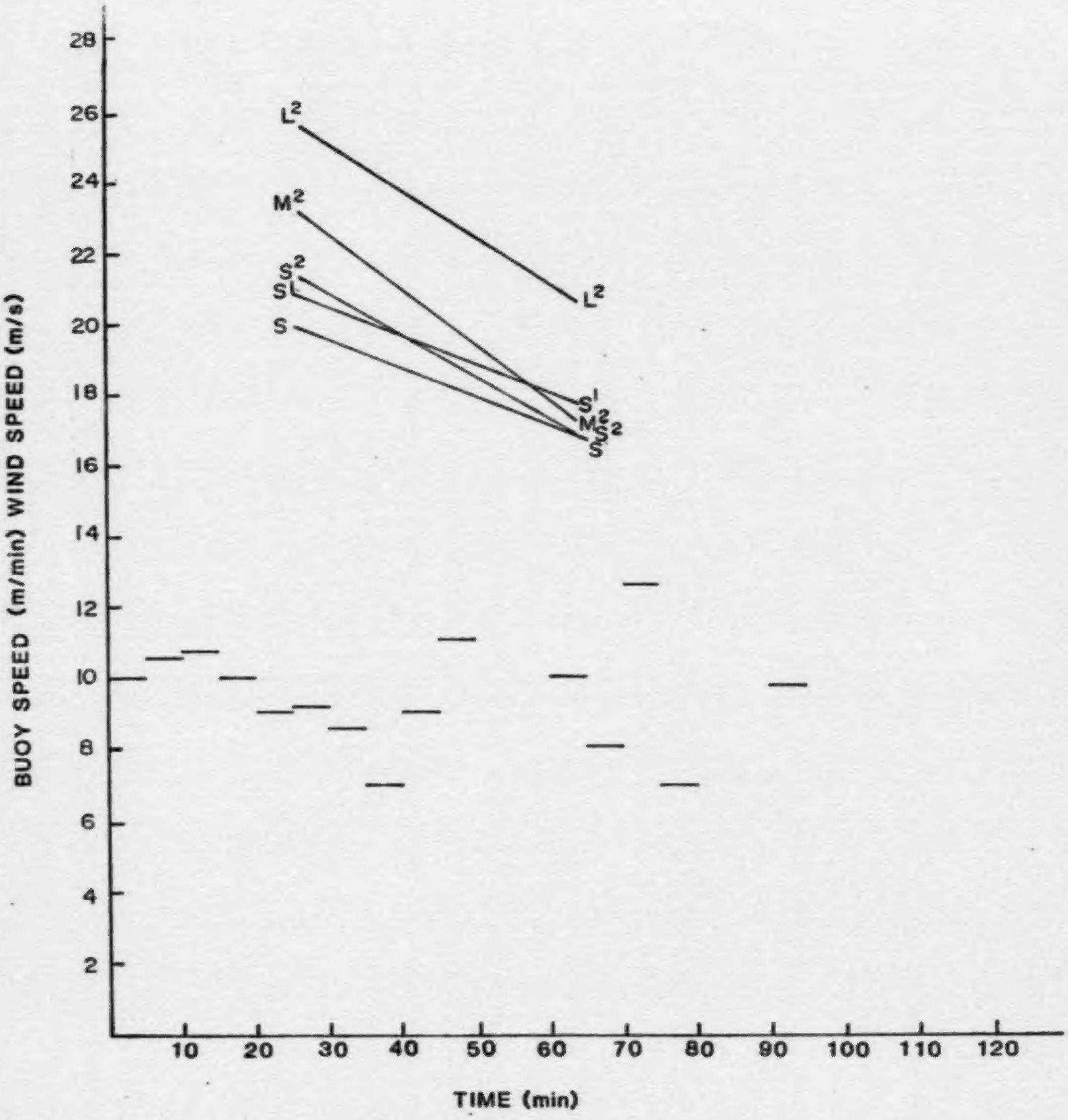

BEDFORD BASIN
LAUNCH
WIND 310° T
5
3
4
5
2
4
3
PRINCE
GYP.
GRAV.
TIDE
ED.
N
0
500
1000 m
SCALE

BUOY TYPE: 5 BIO, SMALL MAST, 10KG
STATIONS: GRAV, GYP
MEAN BUOY SPEED: 18.6 m/min
MEAN WIND SPEED: 9.6 m/s

TRIAL: 46

DATE: MAR 27/85 pm
1323-1510

FIGURE B-202



BUOY SPEED (ABSOLUTE, AT
TIME BETWEEN FIXES) Vs TIME (ELAPSED)

LEGEND

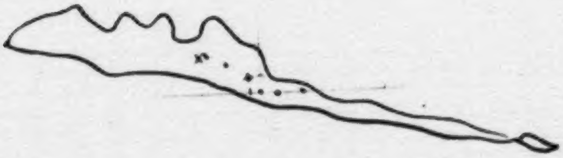
L² - BIO, LARGE MAST, 30KG
M² - BIO, MED. MAST, 30KG
S² - BIO, SMALL MAST, 30KG
S' - BIO, SMALL MAST, 20KG
S - BIO, SMALL MAST, 10KG
-- - WIND

TRIAL : 46
DATE : MAR 27/85 1323-1510
TIDE : HI - 1145
LOW - 1745
AV. WIND SPEED :9.6 m/s
FIGURE : B-203

APPENDIX C

In September, 1983, the Canadian Offshore Aerial Applications Task Force (COAATF) conducted oil slick dispersant trials off the mouth of Halifax Harbour. During the trials five of the BIO Barrel buoys, S^2 type, were deployed in each 'control' slick. From the aerial photos the slick outline and the buoy positions were traced and are presented as figures. The buoy positions appear as dots. For September 16 and 17 there is a small rectangle denoting the attending vessel.

September 12: 4 images
September 16: 14 images
September 17: 12 images

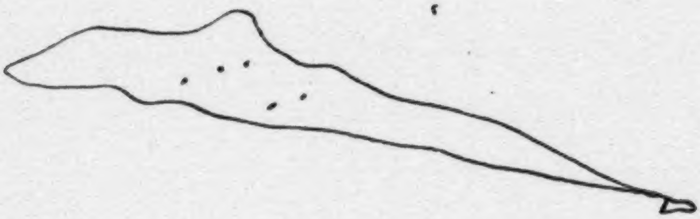


✓DW

AP 18.

CONTROL 12/9/83 1:4000 1421

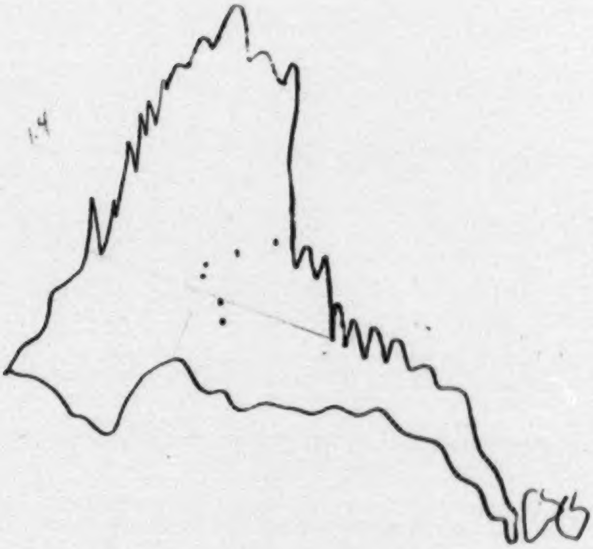
([illegible],



I can only spot one DW

AP 25

CONTROL 12/9/83 1:4000 1430



AP 47 Control 12/9/83 1:7000 16 M

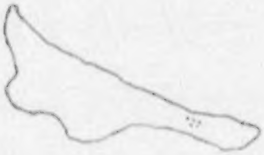
PICTORIALS OF RELATIVE POSITIONS
OF OIL SLICK TRACKING BOUYS

TEST DATE SEPT 16 1983

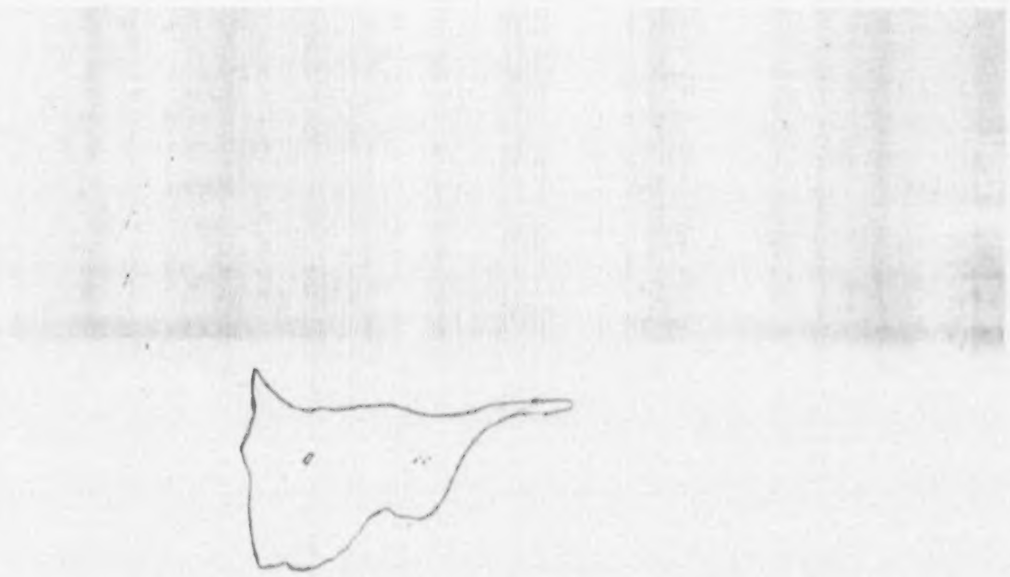
G. BROWN - MACLEAN FEB/85

No anchored vessel
or other position fixing available
for Sept 16/83.

BUOY LOCATIONS ·



OTO 17 CONTROL 16 SEPT 83 1:2370 11:29



OTO 21 CONTROL 16 SEPT 83 1:3600 11:38

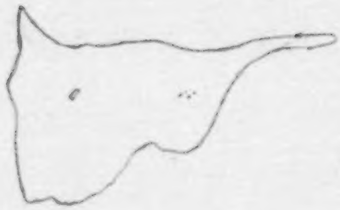
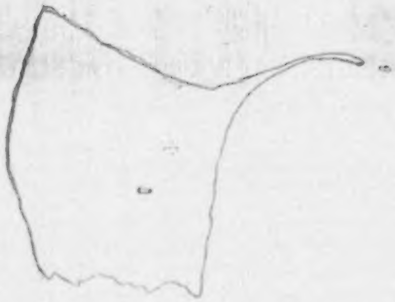


FOTO 21 CONTROL 16 SEPT 83 1:3600 11:38



OTO 23 CONTROL 16 SEPT 83 1:3600 11:45

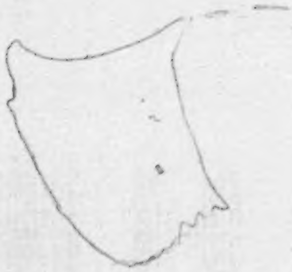
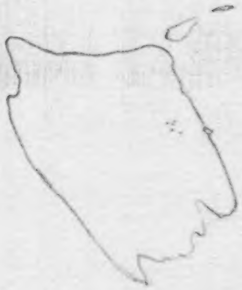
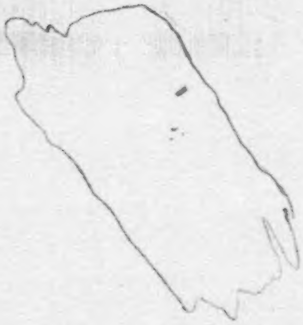


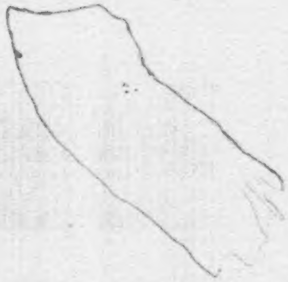
FOTO 25 CONTROL 16 SEPT 83 1:4200 11:52



ATO 29 CONTROL 16 SEPT 83 1:4500 11:58



CONTROL 16 SEPT 83 1:4500 12:05



TO 34 CONTROL 16 SEPT 83 1:5200 12:14

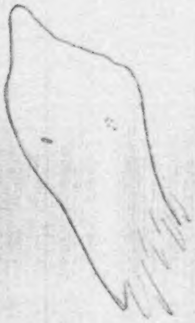
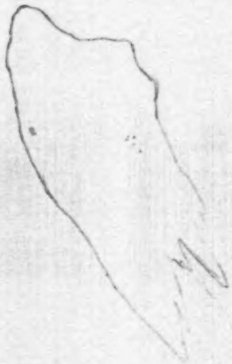
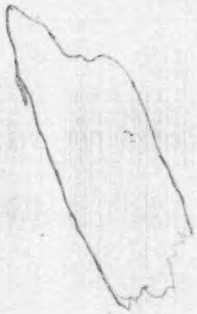


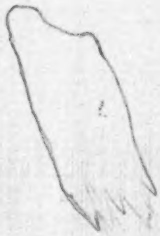
FOTO 37 CONTROL 16 SEPT 83 1:5600 12:19



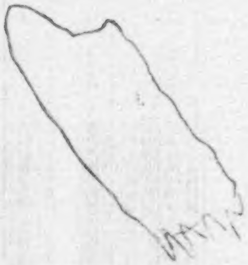
TO 38　　CONTROL　　16 SEPT 83　　1:5400　　12:23



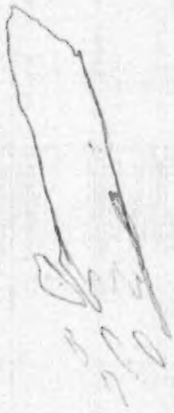
TO 41 CONTROL 16 SEPT 83 1:6600 12:29



TO 45 CONTROL 16 SEPT 83 1:7200 12:44



STO 47 CONTROL 16 SEPT 83 1:7000 12:50



OTO 47 CONTROL 16 SEPT 83 1:7000 13:30

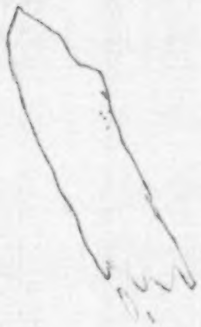
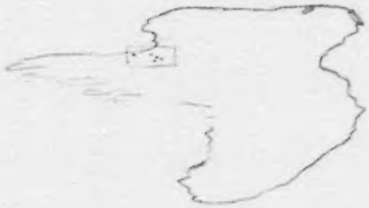


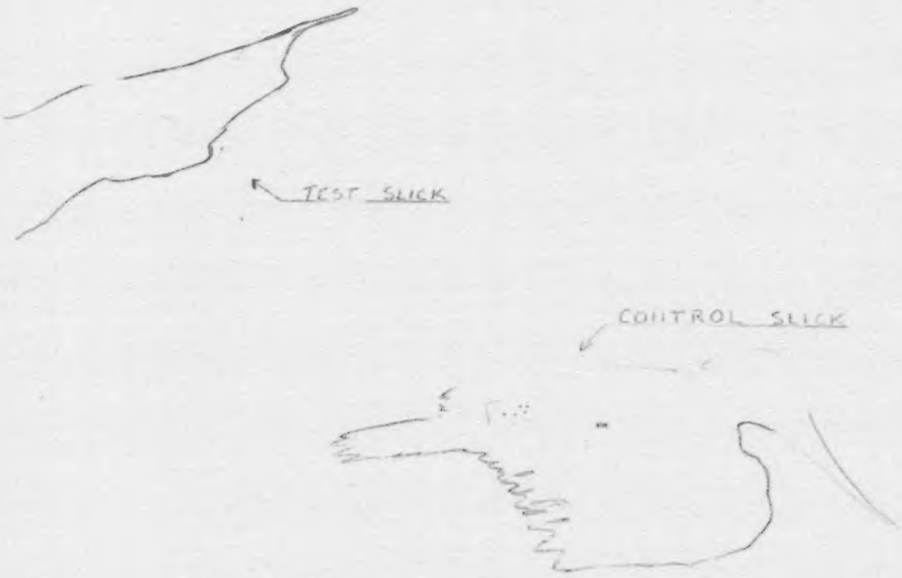
FOTO 52 CONTROL 16 SEPT 83 1:7000 13:45

PICTORIALS OF RELATIVE POSITIONS
OF OIL SLICK TRACKING BUOYS
TEST DATE: SEPT. 17 1983

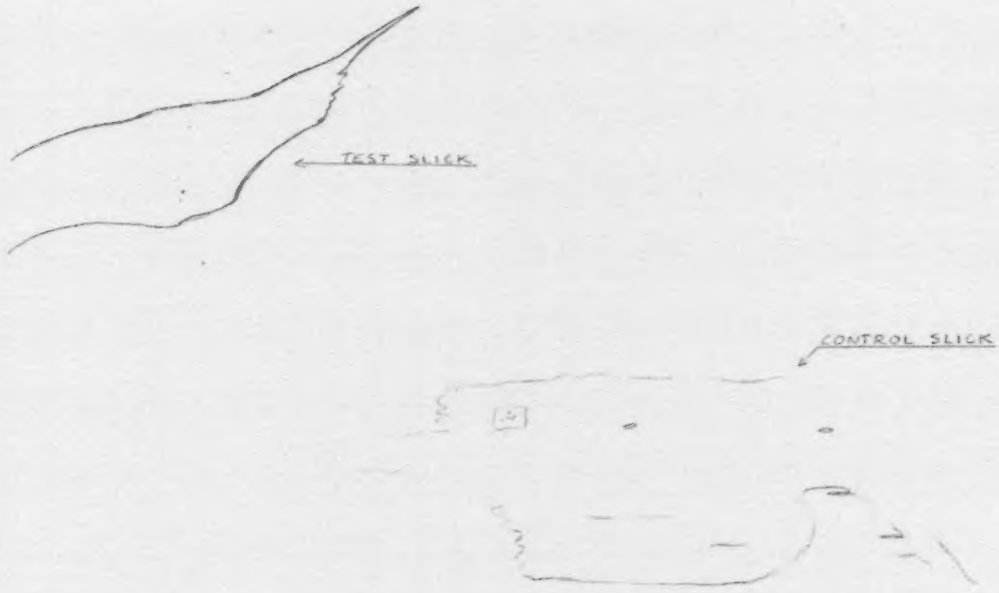
23 CONTROL 17 SEPT 83 1:4800 11:54



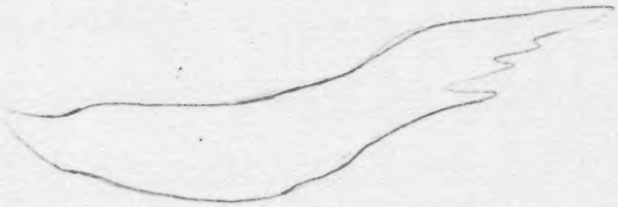
STO 27 CONTROL 17 SEPT 83 1:4800 12:01

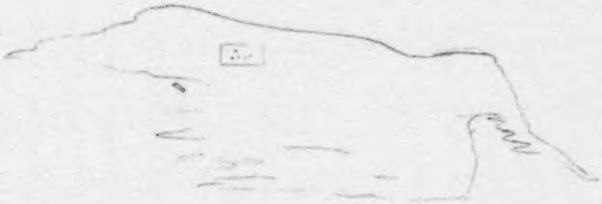

TEST SLICK
CONTROL SLICK

NO 33 CONTROL/TEST 17 SEPT 83 1:5200 12:11


TEST SLICK
CONTROL SLICK

TD 35 CONTROL/TEST 17 SEPT 83 1:5400 12:15





[illegible] 43 CONTROL / TEST 17 SEPT 83 1:7200 12:28

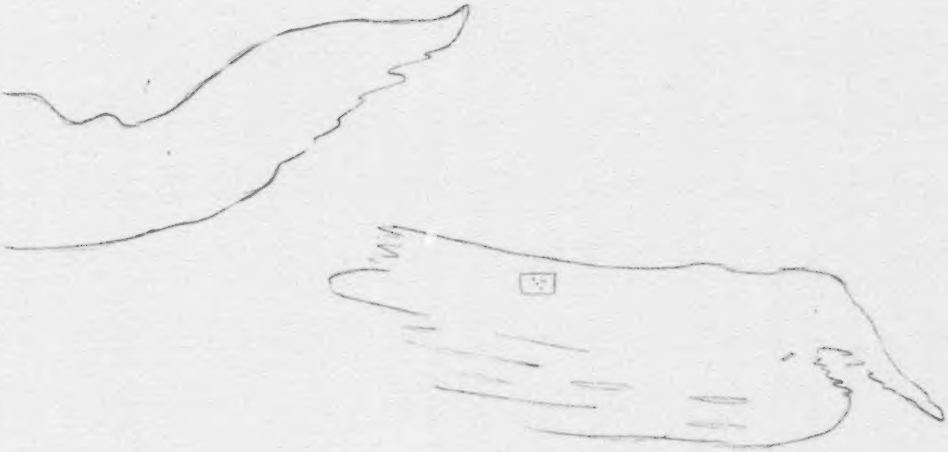
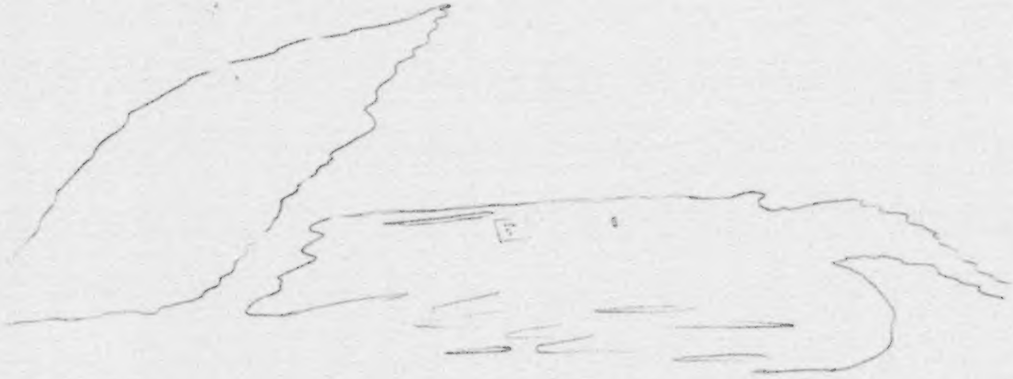
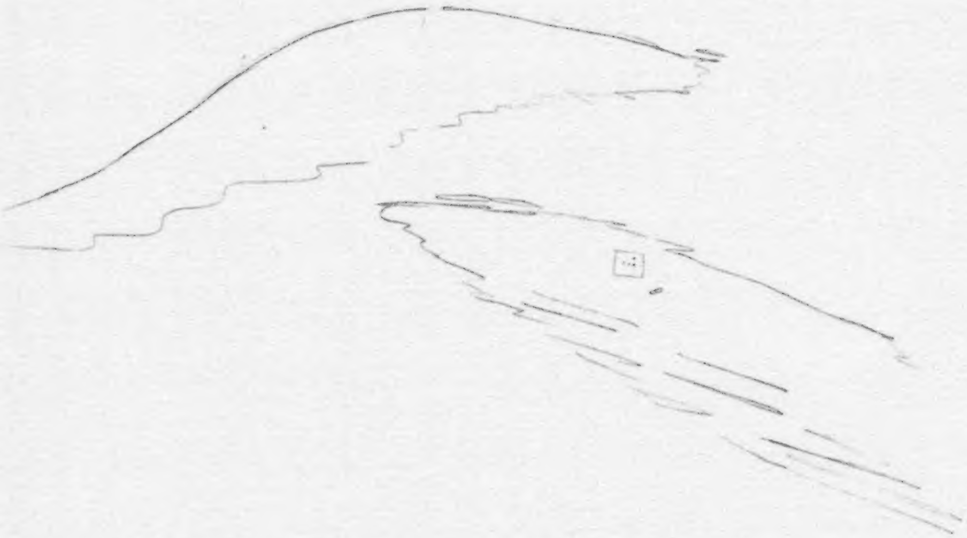


PHOTO 48 CONTROL /TEST 17 SEPT 83 1:7000 12:40



-n 54 CONTROL/TEST 17 SEPT 83 1:6800 12:53



ISTO 57 CONTROL/TEST 17 SEPT 83 1:6800 12:59

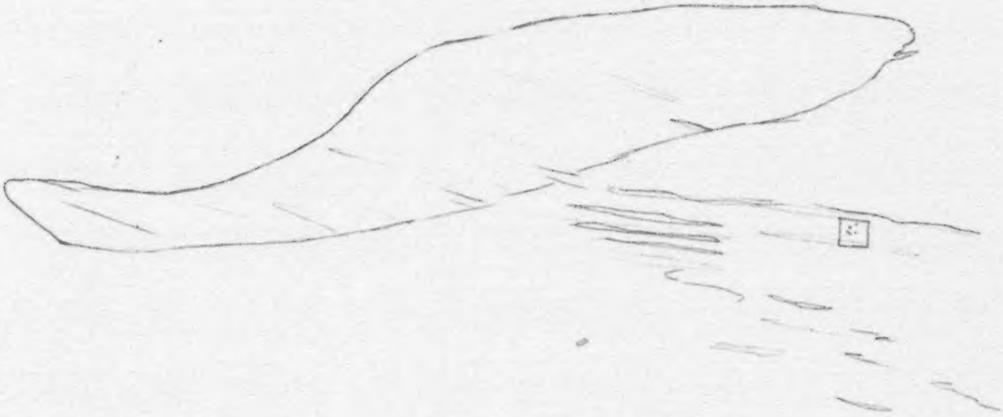
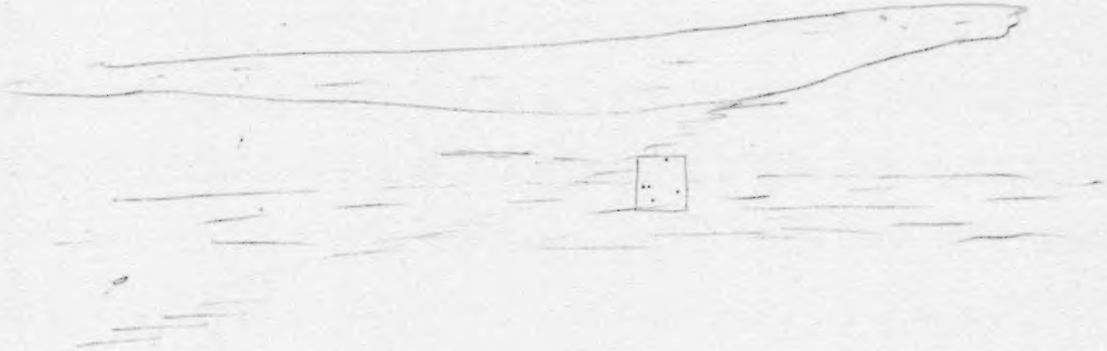
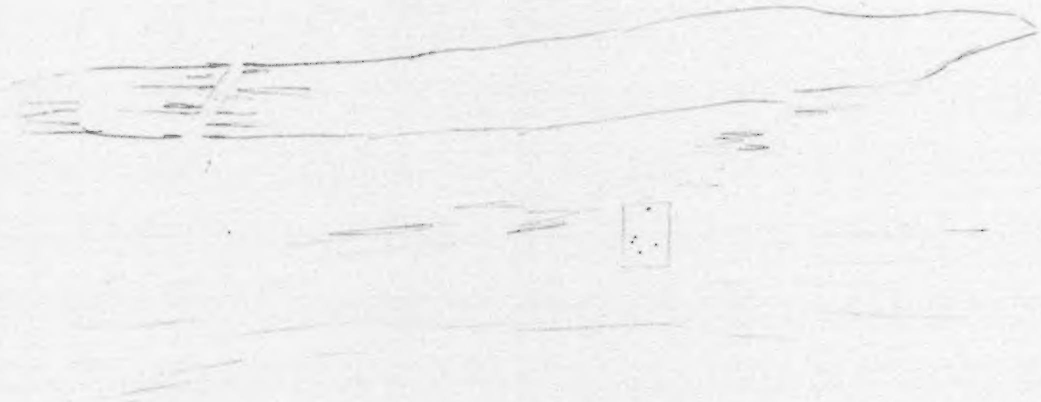


PHOTO 60 CONTROL/TEST 17 SEPT 83 1:6800 13:05



TO 67 CONTROL / TEST 17 SEPT 83 1:6800 1503



1010 74 CONTROL/TEST 17 SEPT 83 1:6800 15:10

STO 77 CONTROL/TEST SEPT 17 83 1 6400 1515